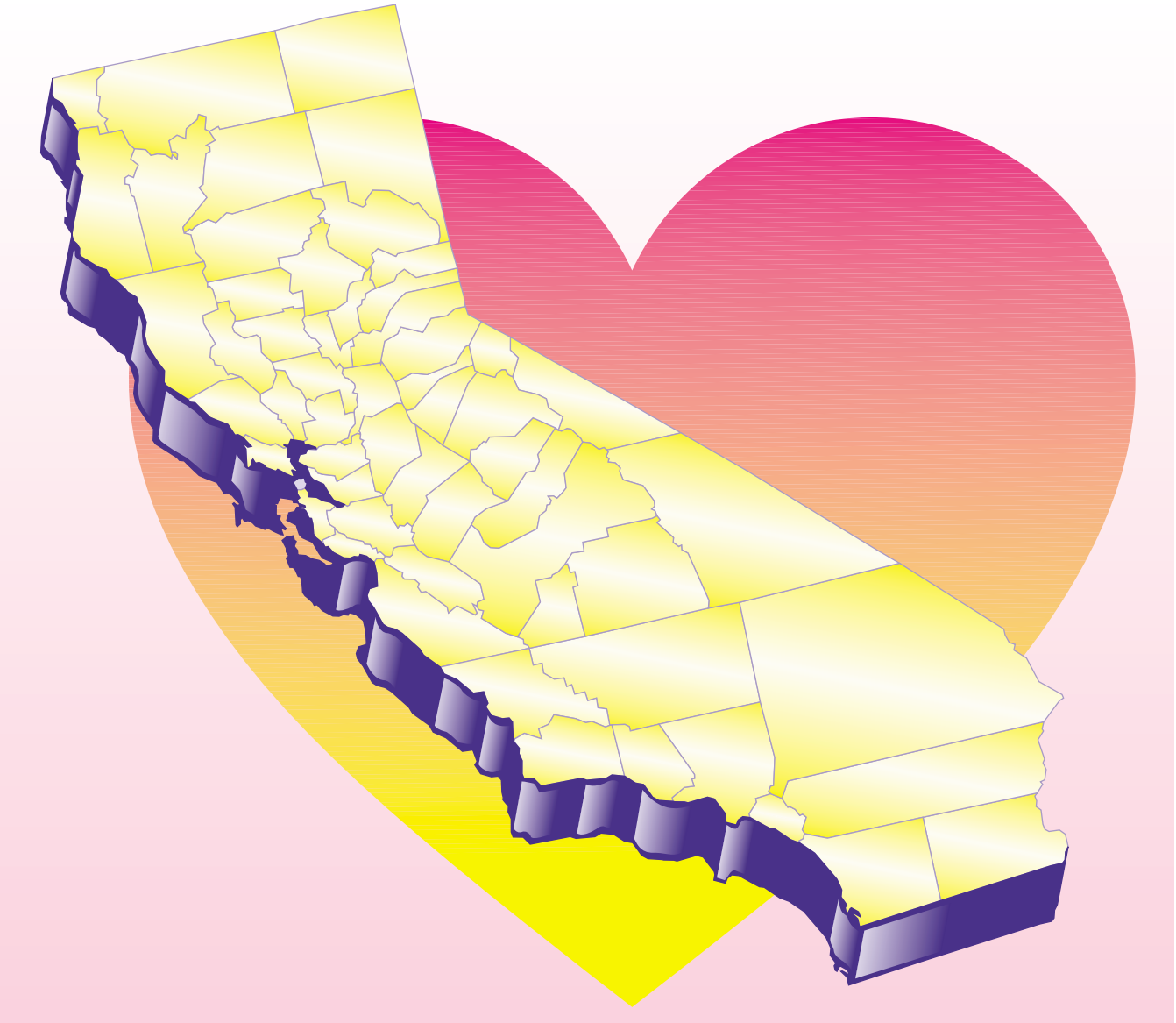
CORE Profiles... The Burden of Cardiovascular Disease

CORE Cardiovascular Disease Outreach, Resources and Epidemiology PROGRAM Report Number 4

Hospitalizations

for Heart Disease and Stroke in California Counties



The Burden

OF CARDIOVASCULAR DISEASE:

Hospitalizations

for Heart Disease and Stroke in California Counties

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CARDIOVASCULAR DISEASE OUTREACH,
RESOURCES AND EPIDEMIOLOGY (CORE) PROGRAM

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UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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Highlights

Ischemic Heart Disease (IHD) and stroke accounted for 26.6 percent of all non-pregnancy related hospitalizations* in California during 1989-1991.

Between 1989 and 1991, close to 1 million hospitalizations occurred for IHD and another 400,000 hospitalizations for stroke.

Ischemic Heart Disease (IHD) or stroke related hospitalizations in California accounted for 26.6 percent of all hospital discharges

ISCHEMIC HEART DISEASE (IHD)

- Fifty-five percent or 540,865 of the hospitalizations for IHD occurred for men and 435,498 (45 percent) for women.
- White men demonstrated the highest discharge rate for IHD (322.6 per 10,000), followed by black women (298.9) and men (292).
- Within each race/ethnicity group, except for blacks, men demonstrated higher hospitalization rates compared to women.
- For males, the greatest disparity between counties in hospital discharge rates is for whites. There is nearly a four-fold difference between the county with the highest IHD discharge rate (Yuba, 460.03) compared to the county with the lowest rate (Del Norte, 132.05).
- For females, the greatest disparity between counties in hospital discharge rates is for other race/ethnic category. There is over a four-fold difference between the county with the highest IHD discharge rate (Riverside, 307.93) compared to the county with the lowest rate (Monterey, 68.48).

STROKE

- There were 18 percent more hospitalizations for stroke for women (218,487) between 1989 and 1991 than for men (185,010).
- The discharge rate for stroke is significantly higher for black men and women compared to both genders for whites, Hispanics, and others.
- Statewide, black women have the highest discharge rate for stroke (200.5). Hispanic men (83.1) and women (85.2) have the lowest discharge rates for stroke.
- For males, the greatest disparity between counties in hospital discharge rates is for whites. There is close to a five-fold difference between the county with the highest discharge rate for stroke (Napa, 139.43) compared to the county with the lowest rate (Del Norte, 30.34).
- For females, the greatest disparity between counties in hospital discharge rates is for whites. There is a four-fold difference between the county with the highest stroke discharge rate (Glenn, 141.76) compared to the county with the lowest rate (Inyo, 34.91).

*"Hospitalizations" and "hospital discharge rates" are used interchangeably throughout this report.

Introduction

Individual suffering from CVD is immeasurable and economic losses due to heart attack and stroke reach in the billions of dollars annually.

Cardiovascular disease (CVD) takes an immense toll on Californians. Individual suffering is immeasurable and economic losses due to heart attack and stroke reach in the billions of dollars annually. A major cause of CVD is atheroslcerosis, the thickening, narrowing, and hardening of the arteries. It is a slowly progressive condition which eventually results in hindered blood flow to and through the heart and brain. Another major cause of heart disease is uncontrolled hypertension which, if not treated, may eventually lead to heart failure. CVD is usually manifested clinically in middle-age or later, but numerous studies have shown that atherosclerosis begins in childhood (1-4).

Hospitalization for heart disease and stroke is one indicator of the morbidity and health care burden associated with CVD. Data from the National Hospital Discharge Survey indicate that in 1989 there were over 3.7 million hospital discharges for all cardiovascular diseases in the U.S., accounting for 50 percent of all hospital discharges nationwide (5). In that same year, there were an estimated 27.7 million physician visits for heart disease alone (6).

In previous CORE Profiles, we described the mortality from heart disease and stroke in California counties and cities. In this report we further define the local burden of CVD by presenting the age-adjusted hospitalization rates for ischemic heart disease (IHD) and stroke, by gender and race/ethnicity, for counties in California.

HOSPITALIZATION DATA

Each year in California, the Office of Statewide Health Planning and Development (OSHPD) collects discharge abstracts on all patients discharged from all hospitals within the State, except federal facilities and special research hospitals. The non-confidential discharge data are made available once they have been edited by OSHPD staff and verified by the individual hospital. We requested hospital discharge data, Tape B (Appendix A), from OSHPD for each of the years 1989-1991.

Hospitalizations which had at least one birth or pregnancy related hospitalization, (International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code 630.00—676.94, V20.0—V39.2 or 760.00—779.00), within the first ten diagnoses, were not included in our analyses. We decided to exclude the birth- or pregnancy- related discharges, which comprised nearly one-third of all the discharges, because giving birth is not considered a disease and our interest is in the diseases of the discharged patients. We selected discharges among persons who were residents of California at the time of hospitalization and with any of the ICD-9 codes for IHD (410.0—414.9) and stroke (430—438) listed in any of the first ten diagnoses on the abstract. The rationale for searching the first ten diagnoses, as opposed to only the primary diagnosis, was to eliminate secular drifts due to any possible changes over time in reimbursement policies which might affect the assignment of primary diagnosis.

As described in Appendix A in further detail, there are several constraints for the use of hospital discharge abstracts, due to necessary protection of patient confidentiality. If a patient was admitted more than once during the three-year period, 1989-1991, each discharge would be counted. In addition, if a person were admitted with more than one diagnosis, e.g. heart disease and stroke, among the first ten, then that discharge was included in each disease category. Therefore, counts for heart disease and stroke are not mutually exclusive counts of discharges.

POPULATION DATA

We obtained California population data by county for the year 1990 from the California Department of Finance, Population Research Unit. The aggregated population size for the three-year period of 1989-1991 was estimated by multiplying the 1990 population size by three.

STATISTICAL METHODS

We calculated ratios of age-adjusted gender- and race-specific rates for each county relative to the age-adjusted gender- and race-specific rates for the entire State. The direct method, described in Appendix B, was used to adjust the rates. We excluded the group aged younger than 35 years from the analyses to increase the reliability of rates, since there are small frequencies of hospitalizations due to heart disease or stroke in this age group.

We used an approximate large sample statistical test described by Flanders to evaluate whether the ratios were significantly different from one (7). This test indicates whether a county has a significantly higher or lower discharge rate compared to California state rate. Discharge rates are expressed as numbers of discharges per 10,000 people.

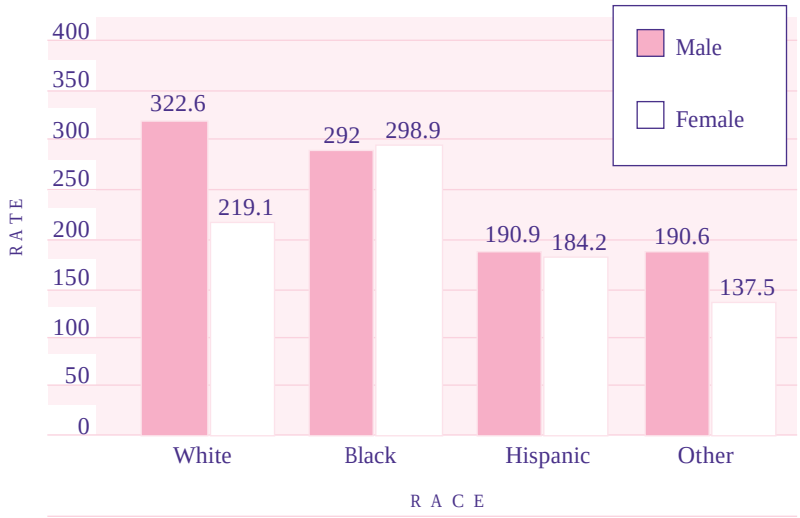
Results

STATEWIDE HOSPITAL DISCHARGE RATES

Ischemic Heart Disease (IHD) and stroke related hospitalizations in California accounted for 26.6 percent of all hospital discharges for the three-year period of 1989-1991. Close to one million hospitalizations occurred during this three year period for IHD alone and another 400,000 hospitalizations for stroke. Fifty-five percent or 540,865 of the hospitalizations for IHD occurred for men and 435,498 (45 percent) for women. There were nearly 20 percent more hospitalizations for stroke for women (218,487) during the three year period than for men (185,010).

Figures 1 and 2 show the age-adjusted hospitalization rates for IHD and stroke, respectively, by race and gender, for California for the aggregated years, 1989-1991. For IHD, white men demonstrate the highest discharge rate (322.6), followed by black women (298.9) and black men (292). Within each race/ethnic group, except for blacks, men demonstrate higher hospitalization rates compared to women. The discharge rate for stroke is significantly higher for black men and women compared to both genders for whites, Hispanics, and others. Black women have the highest discharge rate for stroke (200.5) in the State. Hispanic men (83.1) and women (85.2) have the lowest hospitalization rates for stroke.

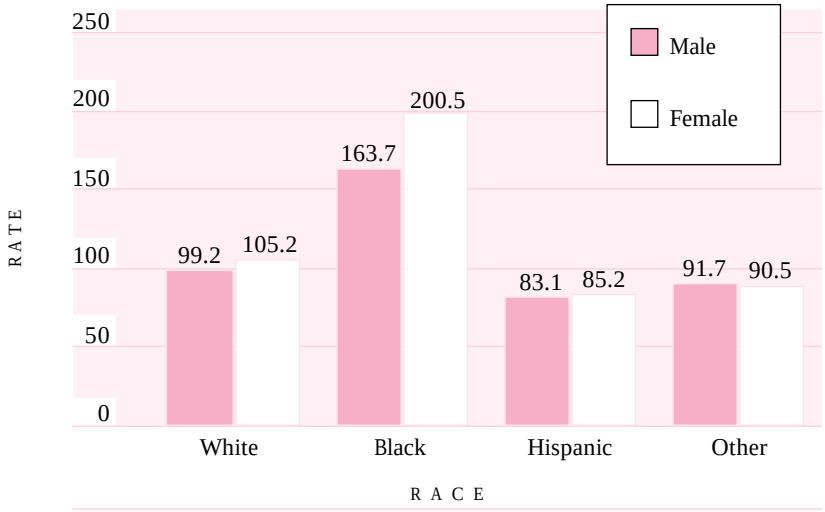
FIGURE 1. AGE-ADJUSTED ISCHEMIC HEART DISEASE HOSPITAL DISCHARGE RATES (PER 10,000) BY RACE AND GENDER FOR CALIFORNIA, 1989-1991



Age-Adjusted to the 1990 California Census population

Source: CORE Program, University of California San Francisco and California Department of Health Services.

FIGURE 2. AGE-ADJUSTED STROKE HOSPITAL DISCHARGE RATES (PER 10,000) BY RACE AND GENDER FOR CALIFORNIA, 1989-1991



Age-Adjusted to the 1990 California Census population

Source: CORE Program, University of California San Francisco and California Department of Health Services.

HOSPITAL DISCHARGE RATES BY COUNTY

All county hospital discharge rates were compared to the state rate for each gender and race, for the respective disease. Considerable variations were found between counties and within counties between gender and race/ethnicity groups (Maps 1-16, Tables 4-14). A great deal of information is presented on these maps, which cannot be easily summarized. Therefore, inspection of the individual maps and tables is recommended, as they convey the most information.

ISCHEMIC HEART DISEASE

Table 1 provides a summary of the counties with significantly high or low IHD age-adjusted hospital discharge rates, compared to the California state rate, by gender and race. For white males, sixteen counties have significantly high IHD hospital discharge rates, while five counties have high rates for black males, nine counties for Hispanic males, and four counties for other males. For white females, fourteen counties have significantly high rates, while six counties have high rates for black females, eight counties for Hispanic females, and two counties for other females.

Tables 2 and 3 show the number of hospital discharges by county and race for males and females, respectively. Considering the entire State, IHD accounts for 24 percent of all hospital discharges for white males and 16.2 percent for white females; 14.7 percent and 14.6 percent for black males and females; 16.4 percent and 14.5 percent for Hispanic males and females; and, 21 percent and 14 percent for other males and females, respectively.

Whites

Map 1 and 2 and Table 4 show the hospital discharge rates, by county, for white males and females. There are substantial variations among the different counties in hospital discharge rates for white males and females. For males, there is nearly a four-fold difference between the county with the highest discharge rate (Yuba, 460.03) compared to the county with the lowest rate (Del Norte, 132.05) and for females over a three-fold difference (Merced, 325.9 vs. Inyo, 105.76).

Ischemic Heart Disease

TABLE 1. COUNTIES WITH SIGNIFICANTLY HIGH OR LOW IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES BY GENDER AND RACE, CALIFORNIA, 1989-1991.

	MALE				FEMALE			
COUNTY	WHITE	BLACK	HISPANIC	OTHER	WHITE	BLACK	HISPANIC	OTHER
Alameda	H		H		H	L	L	
Butte	L				L			
Contra Costa	L		L	H	L		L	
Del Norte	L				L			
El Dorado	L				L			
Fresno	L	L	L	L	L		H	L
Glenn					H			
Humboldt	L				L			
Imperial			H					
Inyo	L				L			
Kern	H	H	H	H	H	H	H	
Kings	H						H	
Lake	H				H			
Lassen	L				L			
Los Angeles	H		H	H	H	H	H	H
Madera			H		H		H	
Marin	L				L			
Mariposa					L			
Merced	H	H	H		H	H	H	
Monterey	L	L	L	L	L	L	L	L
Napa	H				L			
Nevada	L				L			
Orange			L	L			L	L
Placer	H							
Plumas	L				L			
Riverside	H			H	H			H
Sacramento	H			L			L	L
Santa Barbara	L		L	L	L		L	
Santa Clara	L		H	L	L		H	L
Santa Cruz	L				L		L	
San Benito	L							
San Bernardino	H	H	H		H	H	H	
San Diego	L	L	L		L	L	L	
San Francisco		H		L	L		L	L
San Joaquin	H	H			H	H		
San Luis Obispo	L		L		L			
San Mateo	L	L	L		L	L	L	
Shasta	L				L			
Siskiyou	L				L			
Solano		L			H	L	L	
Sonoma	L		L		L			
Stanislaus	H				H		L	
Sutter	H				H			
Tehama					L			
Trinity	L							
Tulare	H		H		H	H	H	
Tuolumne	L				L			
Ventura	L		L		L		L	L
Yolo			L		L			
Yuba	H				L			

Note: Rates are age-adjusted to 1990 California population by gender.

H/L: Rate is significantly higher or lower than the state rate at 0.10 significance level.

Source: Cardiovascular Disease Outreach, Resources & Epidemiology Program.
California Department of Health Services and University of California, San Francisco.

TABLE 2. IHD DISCHARGES FOR MALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

	WHITE		BLACK		HISPANIC		OTHER	
COUNTY	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES
California	**441,026**	**24.0**	**28,720**	**14.7**	**43,483**	**16.4**	**27,636**	**21.0**
Alameda	18,097	24.8	3,245	13.7	1,514	21.8	1,930	22.5
Alpine	3	12.5	0	.	0	.	0	.
Amador	1,015	28.0	4	16.7	9	20.0	3	15.0
Butte	4,536	23.8	21	11.1	98	16.3	39	19.1
Calaveras	1,059	27.6	10	33.3	20	27.4	8	28.6
Colusa	360	24.4	1	14.3	24	14.5	16	32.0
Contra Costa	12,972	23.7	1,006	14.1	543	18.4	815	24.2
Del Norte	362	20.6	1	7.1	4	15.4	5	10.2
El Dorado	2,307	22.4	12	21.8	15	13.8	12	15.8
Fresno	7,879	24.5	356	13.4	1,413	15.0	312	14.9
Glenn	533	23.7	0	.	9	7.6	2	5.6
Humboldt	2,046	18.4	4	5.5	33	29.2	50	13.6
Imperial	1,087	22.6	48	14.7	650	15.7	32	15.6
Inyo	398	24.6	1	20.0	5	10.0	16	17.0
Kern	9,462	26.4	516	20.0	1,226	20.6	419	34.1
Kings	1,242	25.1	90	22.7	247	15.9	27	21.1
Lake	2,132	29.7	47	24.7	33	30.0	32	29.1
Lassen	251	17.9	0	.	0	.	2	10.0
Los Angeles	109,927	23.2	14,314	14.6	18,377	15.1	10,299	21.1
Madera	1,575	28.1	62	20.8	243	21.2	25	20.0
Marin	4,395	24.4	73	13.3	61	20.1	63	17.5
Mariposa	439	25.7	2	20.0	8	15.7	4	30.8
Mendocino	1,852	22.4	7	21.9	19	10.1	56	25.7
Merced	3,230	29.7	151	25.9	485	23.0	77	18.7
Modoc	93	12.5	1	25.0	0	.	1	4.2
Mono	44	11.5	0	.	0	.	2	15.4
Monterey	4,164	23.2	143	17.1	508	14.5	262	20.3
Napa	4,162	28.0	43	18.5	80	18.1	65	31.3
Nevada	2,030	24.9	2	15.4	9	23.1	9	45.0
Orange	35,598	24.6	294	14.6	1,959	14.7	1,584	19.4
Placer	4,028	25.4	11	14.1	83	18.3	50	29.8
Plumas	427	21.3	2	20.0	0	.	7	20.0
Riverside	24,363	26.8	825	19.2	1,749	18.4	561	22.6

Continued

TABLE 2. (CONTINUED) IHD DISCHARGES FOR MALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

	WHITE		BLACK		HISPANIC		OTHER	
COUNTY	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES
Sacramento	18,175	25.0	1,114	15.9	864	18.3	827	19.1
San Benito	543	28.7	2	18.2	180	25.8	21	32.8
San Bernardino	21,627	26.7	1,137	17.6	2,293	18.6	505	22.9
San Diego	34,050	22.9	1,040	12.7	2,320	16.0	1,501	19.7
San Francisco	9,806	17.4	1,712	12.0	1,012	14.5	2,544	17.7
San Joaquin	8,449	27.8	465	19.2	788	17.7	753	23.9
San Luis Obispo	3,864	22.9	25	11.5	114	18.7	40	22.5
San Mateo	10,185	22.8	411	14.6	563	18.5	1,077	24.1
Santa Barbara	5,150	23.0	99	16.8	453	17.2	134	22.8
Santa Clara	18,461	25.8	467	15.4	2,221	19.5	1,917	21.7
Santa Cruz	3,629	23.8	19	11.0	253	16.7	127	23.7
Shasta	3,238	20.6	18	17.6	19	15.0	14	10.8
Sierra	69	25.4	1	50.0	0	.	0	.
Siskiyou	689	17.0	17	21.2	6	12.0	3	12.0
Solano	4,264	24.6	456	17.4	250	20.9	40	24.4
Sonoma	6,623	19.3	56	13.9	115	11.6	99	19.8
Stanislaus	7,663	26.8	96	17.0	454	17.4	158	20.8
Sutter	1,579	25.5	8	11.0	89	19.8	87	20.7
Tehama	1,427	28.2	0	.	22	24.2	2	5.9
Trinity	270	15.9	0	.	2	14.3	0	.
Tulare	5,616	28.4	87	20.0	961	19.9	204	24.7
Tuolumne	1,203	22.2	2	7.4	25	22.5	5	21.7
Ventura	8,764	22.5	134	15.2	896	15.8	285	20.7
Yolo	2,152	22.7	29	12.3	128	13.2	77	21.1
Yuba	1,462	24.7	33	20.6	31	11.4	31	17.9

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.
California Department of Health Services and University of California, San Francisco.

TABLE 3. IHD DISCHARGES FOR FEMALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

	WHITE		BLACK		HISPANIC		OTHER	
COUNTY	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES
California	**341,609**	**16.2**	**33,302**	**14.6**	**42,144**	**14.5**	**18,443**	**14.0**
Alameda	14,553	16.6	3,712	13.7	1,035	16.2	1,200	14.7
Alpine	2	11.8	0	.	0	.	0	.
Amador	652	18.1	4	26.7	2	8.0	3	17.6
Butte	3,073	15.2	19	10.0	89	16.1	23	13.8
Calaveras	613	17.3	3	16.7	5	12.5	2	7.1
Colusa	270	15.7	4	50.0	8	4.7	16	32.7
Contra Costa	8,915	14.0	1,116	12.9	371	13.2	459	13.7
Del Norte	310	15.9	2	40.0	1	4.5	14	14.7
El Dorado	1,332	12.9	2	7.4	13	8.1	5	8.2
Fresno	6,219	16.2	519	15.0	1,461	14.4	213	10.2
Glenn	419	15.9	0	.	7	8.9	0	.
Humboldt	1,553	12.8	5	11.4	12	13.3	44	10.8
Imperial	690	16.3	41	14.5	534	12.5	17	12.4
Inyo	382	20.5	1	11.1	4	8.7	17	16.8
Kern	7,699	19.0	492	19.2	1,230	20.0	153	17.9
Kings	879	15.7	48	11.7	231	15.0	14	9.7
Lake	1,490	21.1	26	16.6	8	11.0	15	16.5
Lassen	210	11.7	0	.	3	30.0	0	.
Los Angeles	93,275	16.6	17,876	14.8	20,371	14.2	7,739	15.3
Madera	1,362	22.1	70	19.2	253	20.0	10	12.5
Marin	2,694	13.6	72	17.7	31	11.4	33	8.3
Mariposa	318	17.4	2	25.0	1	6.7	2	16.7
Mendocino	1,414	15.4	7	14.0	18	13.8	56	21.5
Merced	2,572	22.4	157	22.0	476	22.4	45	11.7
Modoc	65	8.7	1	33.3	0	.	0	.
Mono	32	9.7	0	.	0	.	4	33.3
Monterey	3,077	14.6	99	12.6	401	11.0	115	9.8
Napa	2,083	15.9	15	31.9	48	11.8	15	11.5

Continued

TABLE 3. (CONTINUED) IHD DISCHARGES FOR FEMALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

	WHITE		BLACK		HISPANIC		OTHER	
COUNTY	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES
Nevada	1,330	15.4	0	.	2	5.0	1	6.7
Orange	28,238	15.7	229	10.6	1,759	12.0	966	11.1
Placer	2,734	15.8	13	20.3	63	17.4	24	12.4
Plumas	292	12.5	0	.	2	9.1	3	9.7
Riverside	18,431	18.8	758	15.6	1,499	15.7	476	17.4
Sacramento	12,598	15.4	1,104	14.4	489	12.0	468	11.5
San Benito	367	19.2	1	8.3	117	14.7	5	12.2
San Bernardino	18,316	19.1	1,384	17.2	2,084	15.4	368	14.4
San Diego	24,872	14.7	1,241	12.8	2,215	14.3	1,050	12.8
San Francisco	7,822	14.8	1,939	14.7	825	11.9	1,791	13.0
San Joaquin	6,791	19.7	486	20.3	720	17.7	371	17.2
San Luis Obispo	2,911	15.4	18	11.5	63	11.2	11	7.1
San Mateo	6,963	13.5	384	12.3	390	11.0	635	13.8
Santa Barbara	3,663	13.9	86	13.3	424	15.2	74	14.1
Santa Clara	12,347	15.0	462	13.5	2,217	17.4	1,100	13.0
Santa Cruz	2,735	15.2	1	16.1	184	13.0	60	16.6
Shasta	2,119	1.6	10	11.8	9	9.3	8	4.6
Sierra	40	13.2	1	100.0	1	50.0	1	20.0
Siskiyou	631	14.5	5	8.8	9	16.7	0	.
Solano	3,146	16.5	453	13.5	170	16.3	260	13.7
Sonoma	5,084	12.6	36	10.0	61	7.5	64	10.6
Stanislaus	6,503	19.3	59	14.2	297	13.5	124	17.8
Sutter	1,176	17.5	15	12.0	49	13.4	45	16.0
Tehama	845	16.5	0	.	14	19.2	2	5.1
Trinity	234	12.2	0	.	2	20.0	1	4.5
Tulare	5,505	23.5	118	26.9	1,004	18.8	100	16.1
Tuolumne	708	12.4	0	.	6	8.6	6	16.2
Ventura	6,625	13.9	134	13.5	756	12.9	162	10.9
Yolo	1,462	14.6	36	15.7	82	10.6	43	13.1
Yuba	968	17.1	19	15.2	18	11.2	10	8.3

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

For white males, Map 1 shows three clusters of high-rate counties extending from the central valley into Southern California. The largest cluster consists of eight counties including: Yuba, Sutter, Placer, Sacramento, San Joaquin, Stanislaus, Merced, and Alameda. Also notable is the cluster of six high-rate counties in Southern California - Kings, Tulare, Kern, Los Angeles, San Bernardino, and Riverside counties.

The geographical variation of IHD hospital discharge rates for white females is shown on Map 2. A slightly different pattern emerges for white females compared to white males. We see fewer high-rate counties in the northern portion of the central valley. Similar to that found for males, however, is the cluster in Southern California with Tulare, Kern, Los Angeles, San Bernardino, and Riverside counties demonstrating significantly higher IHD hospital discharge rates for white females.

Blacks

Maps 3 and 4 and Table 5 show the data, by county, for black males and females. For both males and females there is over a two-fold difference between the county with the highest hospital discharge rate compared to the county with the lowest rate (Table 5). No real geographic pattern of high-rate counties emerges for blacks; however, there is a cluster of four high-rate counties in Southern California (Tulare, Kern, Los Angeles, and San Bernardino) for black females.

Hispanics

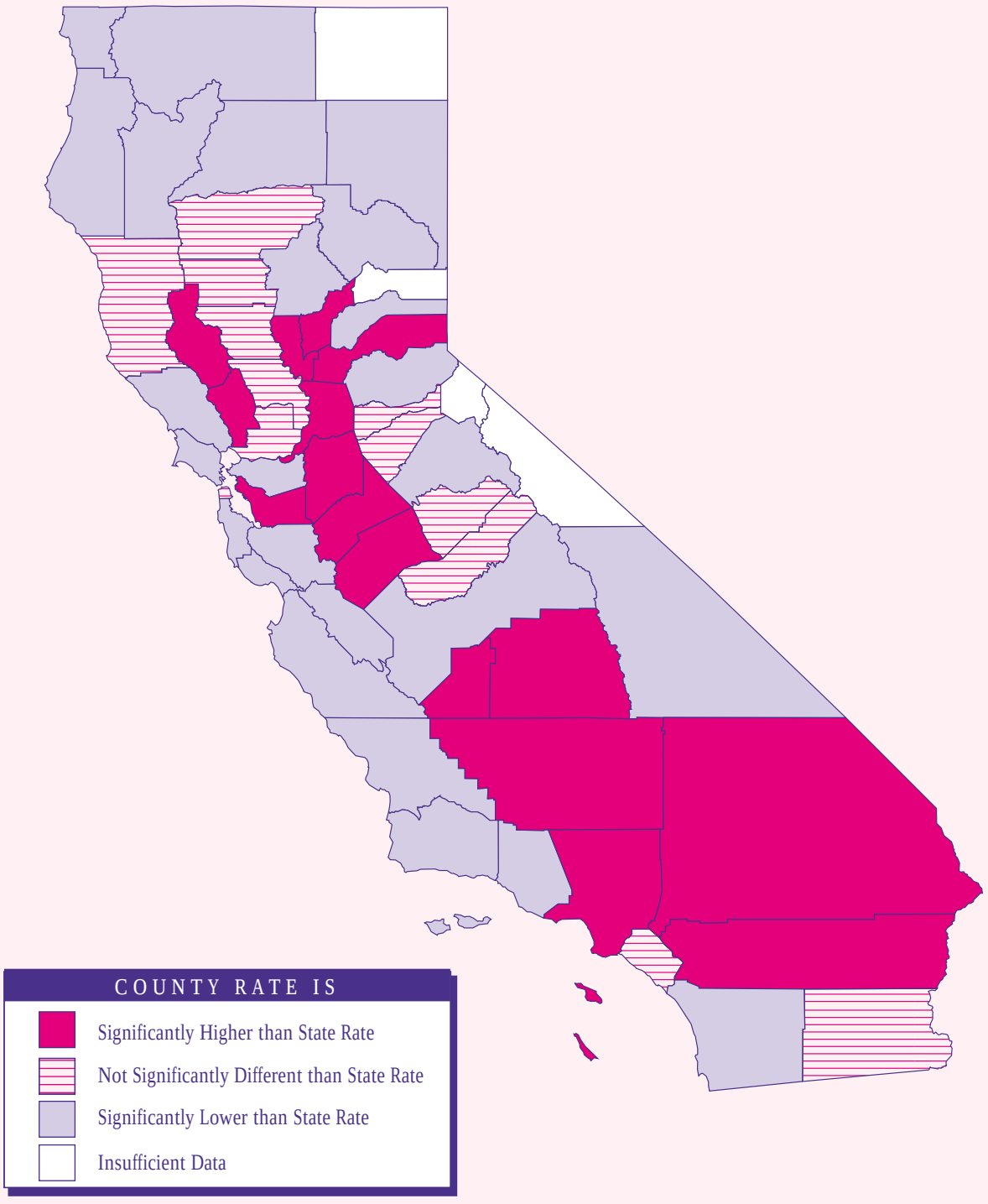
Maps 5 and 6 and Table 6 show the data, by county, for Hispanic males and females. For males, there is over a two-fold difference between the county with the highest hospital discharge rate (San Bernardino, 212.56) compared to the county with the lowest rate (Sonoma, 84.2). For females, there is over a three-fold difference between the county with the highest rate (Kern, 333.61) compared to the county with the lowest rate (San Mateo, 95.05).

Map 5 shows a similar cluster of four high-rate counties in Southern California (Tulare, Kern, Los Angeles, and San Bernardino) for Hispanic males that was seen for black females. Map 6 for Hispanic females, however, shows an extensive region of nine high-rate counties, extending from Santa Clara through the central valley into Southern California.

Others

Maps 7 and 8 and Table 7 show the data, by county, for other males and females. For males, there is over a two-fold difference between the county with the highest hospital discharge rate (Riverside, 304.0) compared to the county with the lowest rate (Fresno, 119.08). For females, there is over a four-fold difference between the county with the highest rate (Riverside, 307.93) compared to the county with the lowest rate (Monterey, 68.48). The geographic pattern of counties with significantly high or low IHD hospital discharge rates is not impressive for either other males or females.

MAP 1. COUNTIES WITH IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR WHITE MALES IN CALIFORNIA, 1989-1991.



Map 2 Counties with IHD Age-Adjusted Hospital Discharge Rates Significantly Different from the State Rate for White Females in California, 1989-1991.

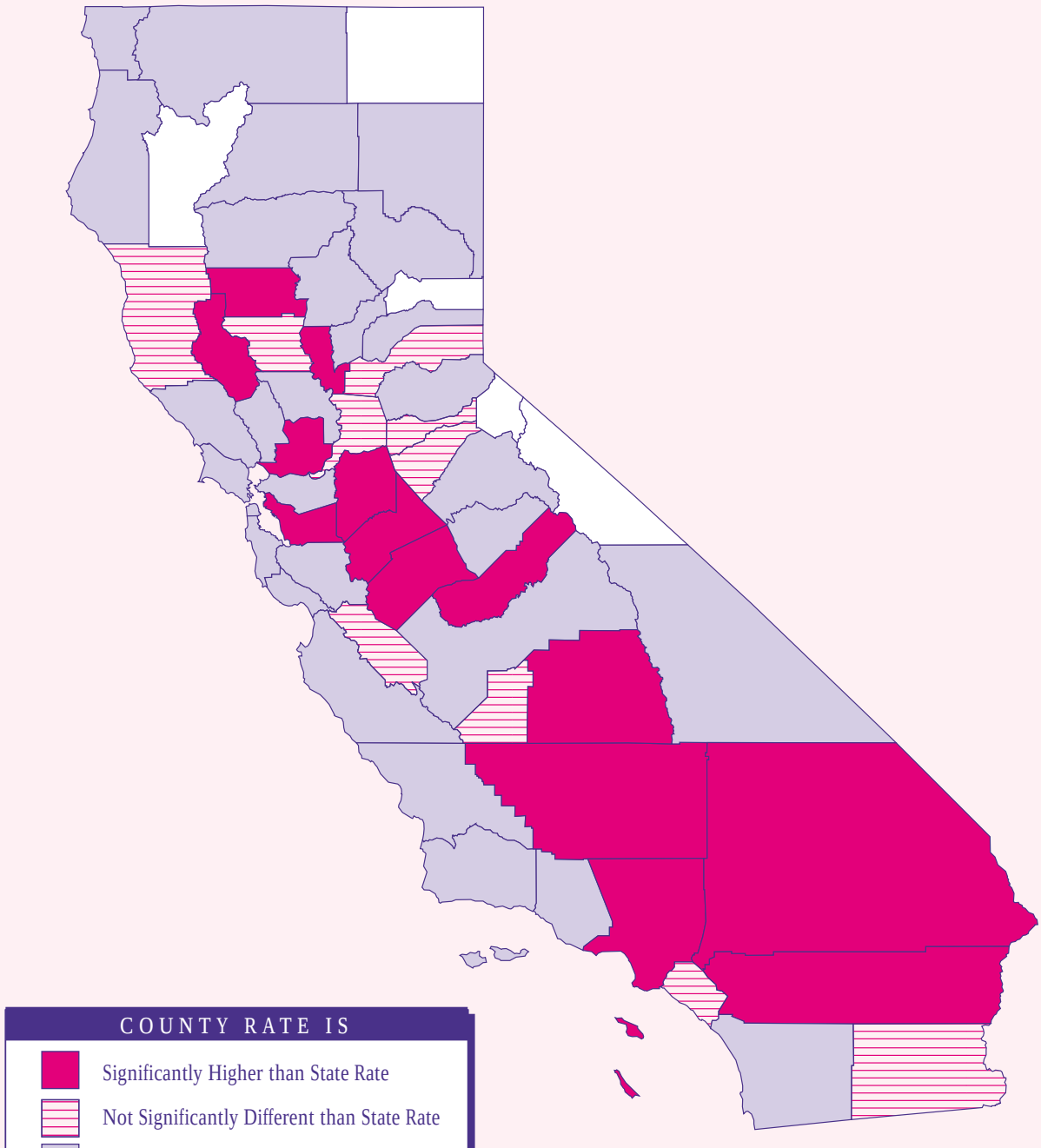


TABLE 4. IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR WHITE CALIFORNIANS, BY GENDER, 1989-1991.

MALE

QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO
Highest			
	Yuba	460.03	1.43**
	Merced	441.10	1.37**
	Napa	439.59	1.36**
	Sutter	415.95	1.29**
	Stanislaus	398.45	1.23**
	Lake	395.91	1.23**
	Tulare	386.72	1.20**
	San Joaquin	380.98	1.18**
	Kern	380.23	1.18**
	San Bernardino	367.22	1.14**
	Alameda	361.48	1.12**
	Colusa	358.03	1.11
	Kings	357.84	1.11**
	Sacramento	355.19	1.10**
Third			
	Los Angeles	348.46	1.08**
	Placer	347.85	1.08**
	Amador	346.10	1.07
	Riverside	344.51	1.07**
	Calaveras	339.89	1.05
	Solano	330.02	1.02
	Yolo	329.67	1.02
	Tehama	325.72	1.01
	California	**322.64**	**1.00**
	Orange	319.39	0.99
	Madera	318.43	0.99
	San Francisco	314.89	0.98
	Mendocino	314.54	0.97
	Imperial	309.75	0.96
Second			
	Glenn	306.77	0.95
	Mariposa	306.06	0.95
	Santa Clara	305.71	0.95*
	Contra Costa	305.18	0.95*
	Butte	305.01	0.95*

FEMALE

QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO
Highest			
	Merced	325.90	1.49**
	Tulare	322.25	1.47**
	Stanislaus	288.37	1.32**
	Kern	286.43	1.31**
	San Bernardino	281.09	1.28**
	Sutter	276.41	1.26**
	San Joaquin	264.83	1.21**
	Madera	264.68	1.21**
	Glenn	259.37	1.18**
	Lake	255.60	1.17**
	Colusa	251.97	1.15
	Los Angeles	249.08	1.14**
	Alameda	242.57	1.11**
	Riverside	236.49	1.08**
Third			
	Solano	236.38	1.08**
	Kings	230.38	1.05
	Amador	230.05	1.05
	San Benito	229.38	1.05
	Placer	227.39	1.04
	Mendocino	226.20	1.03
	California	**219.11**	**1.00**
	Orange	215.90	0.99
	Sacramento	215.09	0.98
	Imperial	209.44	0.96
	Yolo	202.07	0.92*
	Calaveras	201.87	0.92
	Napa	197.71	0.90*
	San Francisco	196.44	0.90*
Second			
	Ventura	190.20	0.87*
	Fresno	188.48	0.86*
	Contra Costa	187.99	0.86*
	Humboldt	183.70	0.84*
	Tehama	183.30	0.84*

Continued

TABLE 4. (CONTINUED) IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR WHITE CALIFORNIANS, BY GENDER, 1989-1991.

MALE

QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO
	Santa Cruz	291.00	0.90*
	Fresno	287.70	0.89*
	Monterey	286.22	0.89*
	Shasta	284.67	0.88*
	San Mateo	282.52	0.88*
	Ventura	277.59	0.86*
	Marin	274.03	0.85*
	San Diego	266.83	0.83*
	Nevada	260.32	0.81*
Lowest			
	Humboldt	258.25	0.80*
	El Dorado	255.32	0.79*
	Sonoma	254.52	0.79*
	San Luis Obispo	254.25	0.79*
	San Benito	251.54	0.78*
	Santa Barbara	245.83	0.76*
	Tuolumne	238.94	0.74*
	Plumas	221.21	0.69*
	Inyo	190.84	0.59*
	Siskiyou	179.47	0.56*
	Trinity	157.36	0.49*
	Lassen	145.49	0.45*
	Del Norte	132.05	0.41*

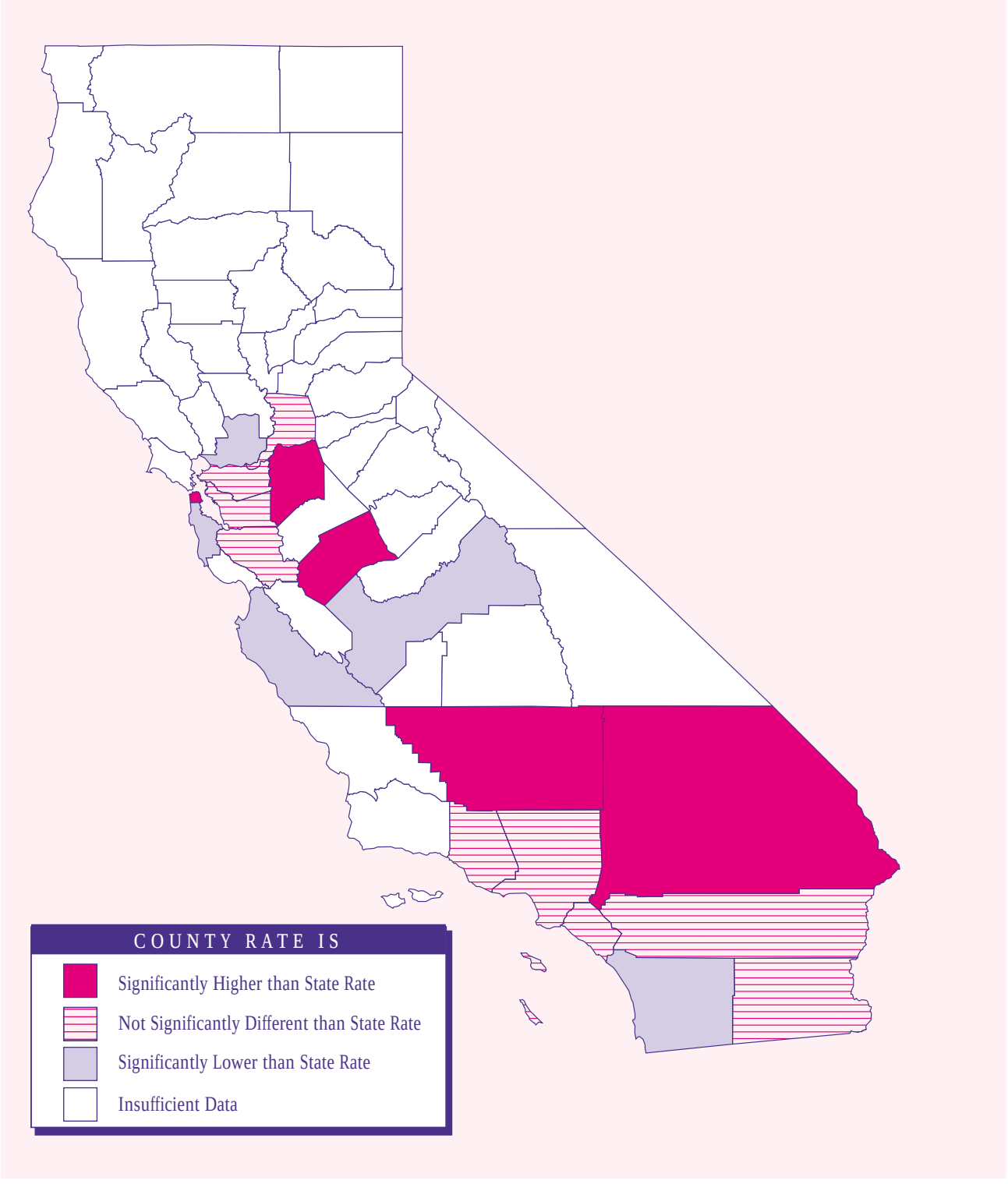
FEMALE

QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO
	Santa Clara	182.21	0.83*
	Butte	180.43	0.82*
	Santa Cruz	179.97	0.82*
	Monterey	179.80	0.82*
	Shasta	178.51	0.81*
	San Diego	174.64	0.80*
	San Luis Obispo	172.35	0.79*
	Nevada	170.11	0.78*
	San Mateo	167.79	0.77*
Lowest			
	Sonoma	165.15	0.75*
	Plumas	164.81	0.75*
	Del Norte	162.61	0.74*
	Mariposa	160.04	0.73*
	Siskiyou	159.55	0.73*
	El Dorado	157.84	0.72*
	Marin	154.94	0.71*
	Santa Barbara	145.38	0.66*
	Lassen	137.29	0.63*
	Yuba	125.62	0.57*
	Tuolumne	107.40	0.49*
	Inyo	105.76	0.48*

Note: Rates are per 10,000 population and adjusted to 1990 California Population
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.
California Department of Health Services, and University of California at San Francisco.

MAP 3. COUNTIES WITH IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR BLACK MALES IN CALIFORNIA, 1989-1991.



Map 4. Counties with IHD Age-Adjusted Hospital Discharge Rates Significantly Different from the State Rate for Black Females in California, 1989-1991.

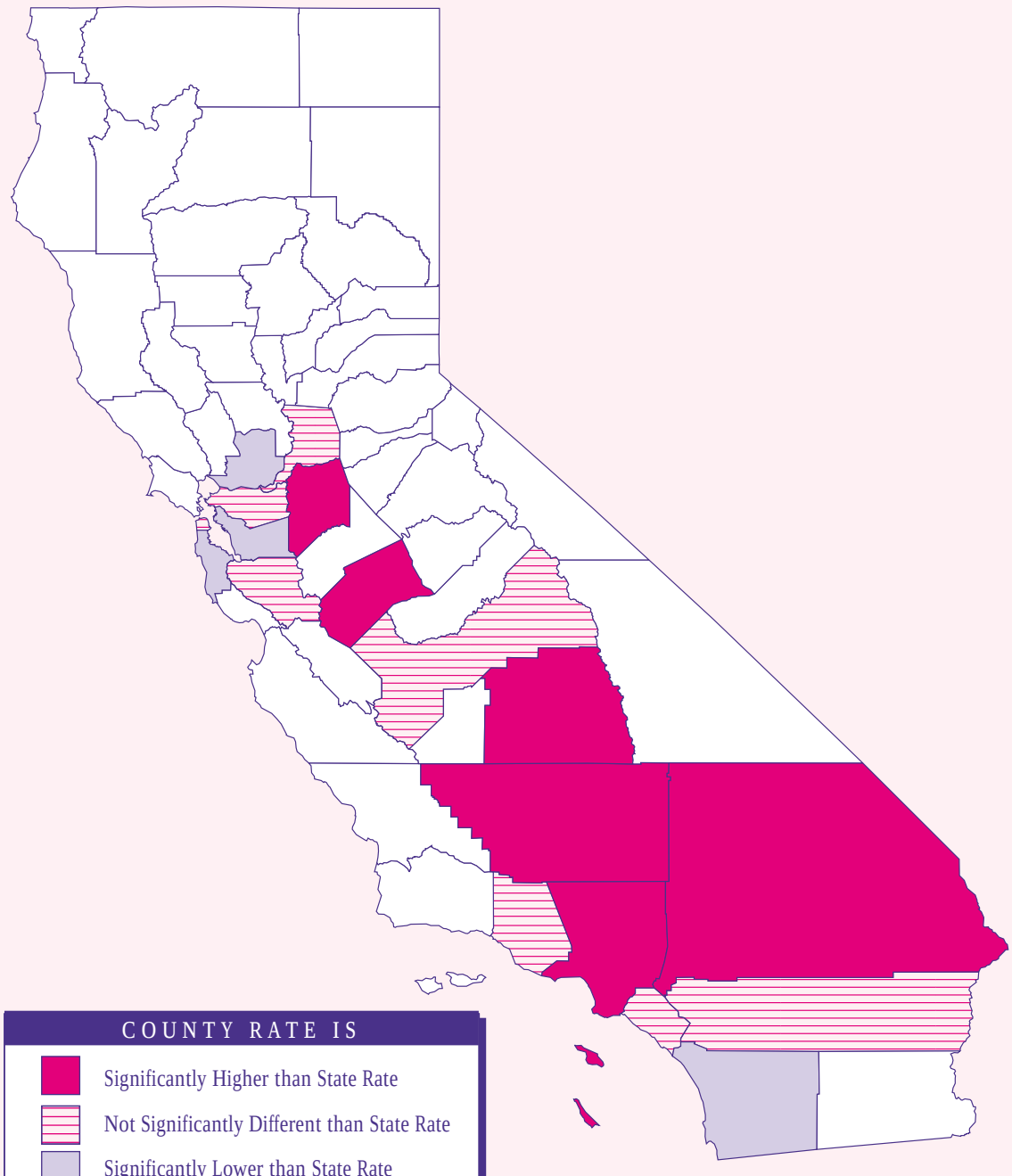


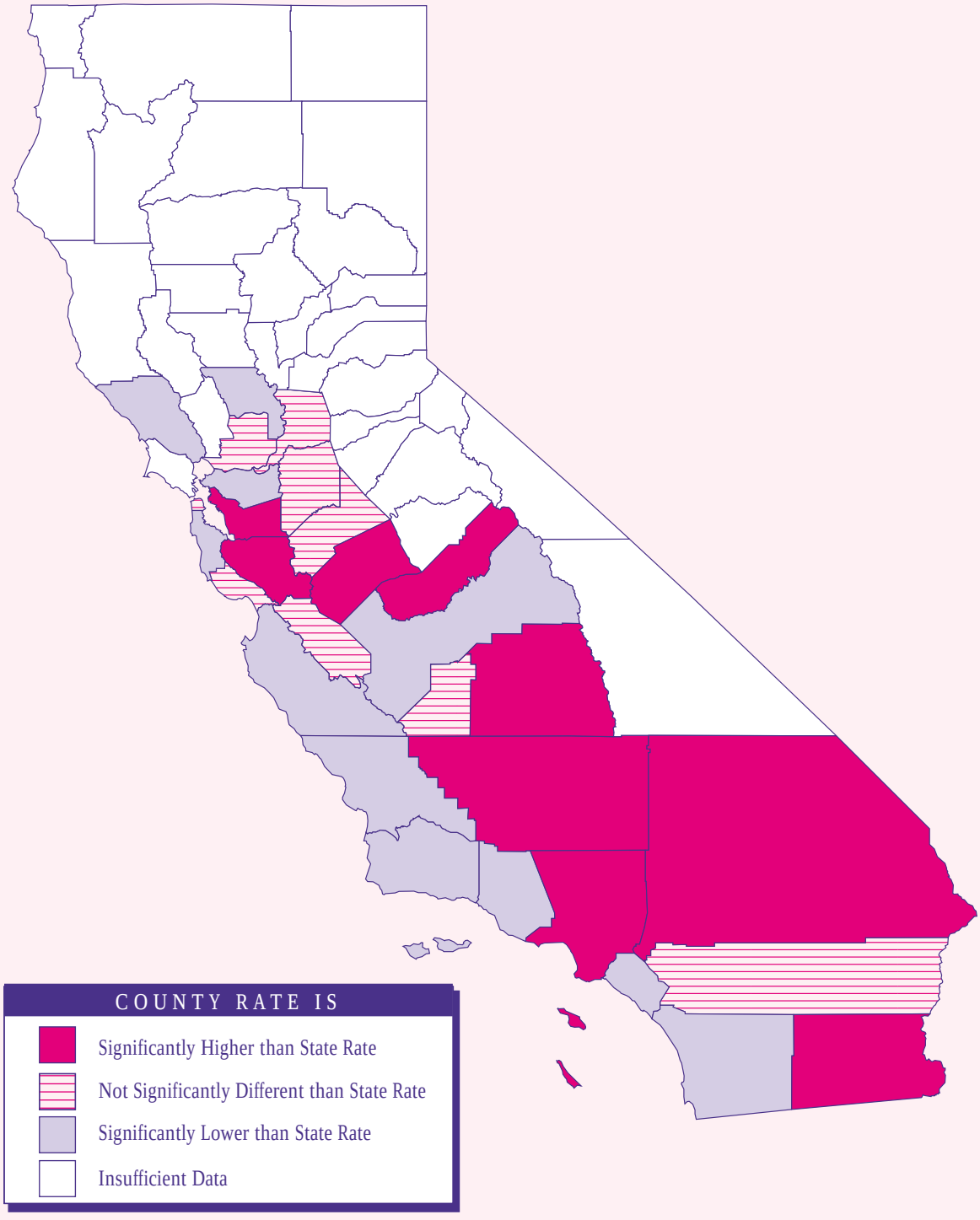
TABLE 5. IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR BLACK CALIFORNIANS, BY GENDER, 1989-1991.

MALE COUNTY	DISCHARGE RATE	RELATIVE RATIO	FEMALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Merced	386.81	1.32**	Tulare	463.21	1.55**
Kern	381.42	1.31**	Merced	401.75	1.34**
San Joaquin	364.68	1.25**	San Bernardino	389.48	1.30**
San Bernardino	336.05	1.15**	San Joaquin	376.67	1.26**
San Francisco	325.39	1.11**	Kern	351.55	1.18**
Riverside	307.29	1.05	Santa Clara	327.26	1.09
Los Angeles	299.19	1.02	San Francisco	317.67	1.06
Santa Clara	294.25	1.01	Los Angeles	309.17	1.03**
Orange	292.20	1.00	Fresno	299.36	1.00
California	**291.97**	**1.00**	**California**	**298.91**	**1.00**
Sacramento	291.16	1.00	Ventura	289.88	0.97
Contra Costa	285.96	0.98	Contra Costa	286.73	0.96
Alameda	280.21	0.96	Sacramento	285.66	0.96
Ventura	242.51	0.83	Riverside	275.88	0.92
Solano	236.35	0.81*	Solano	270.08	0.90*
Fresno	233.92	0.80*	Alameda	266.71	0.89*
San Mateo	230.93	0.79*	San Diego	255.89	0.86*
Imperial	228.55	0.78	Orange	250.61	0.84
San Diego	225.29	0.77*	San Mateo	215.05	0.72*
Monterey	181.22	0.62*			

Note: Rates are per 10,000 population and adjusted to 1990 California Population.
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.
California Department of Health Services, and University of California at San Francisco.

MAP 5. COUNTIES WITH IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR HISPANIC MALES IN CALIFORNIA, 1989-1991.



MAP 6. COUNTIES WITH IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR HISPANIC FEMALES IN CALIFORNIA, 1989-1991.

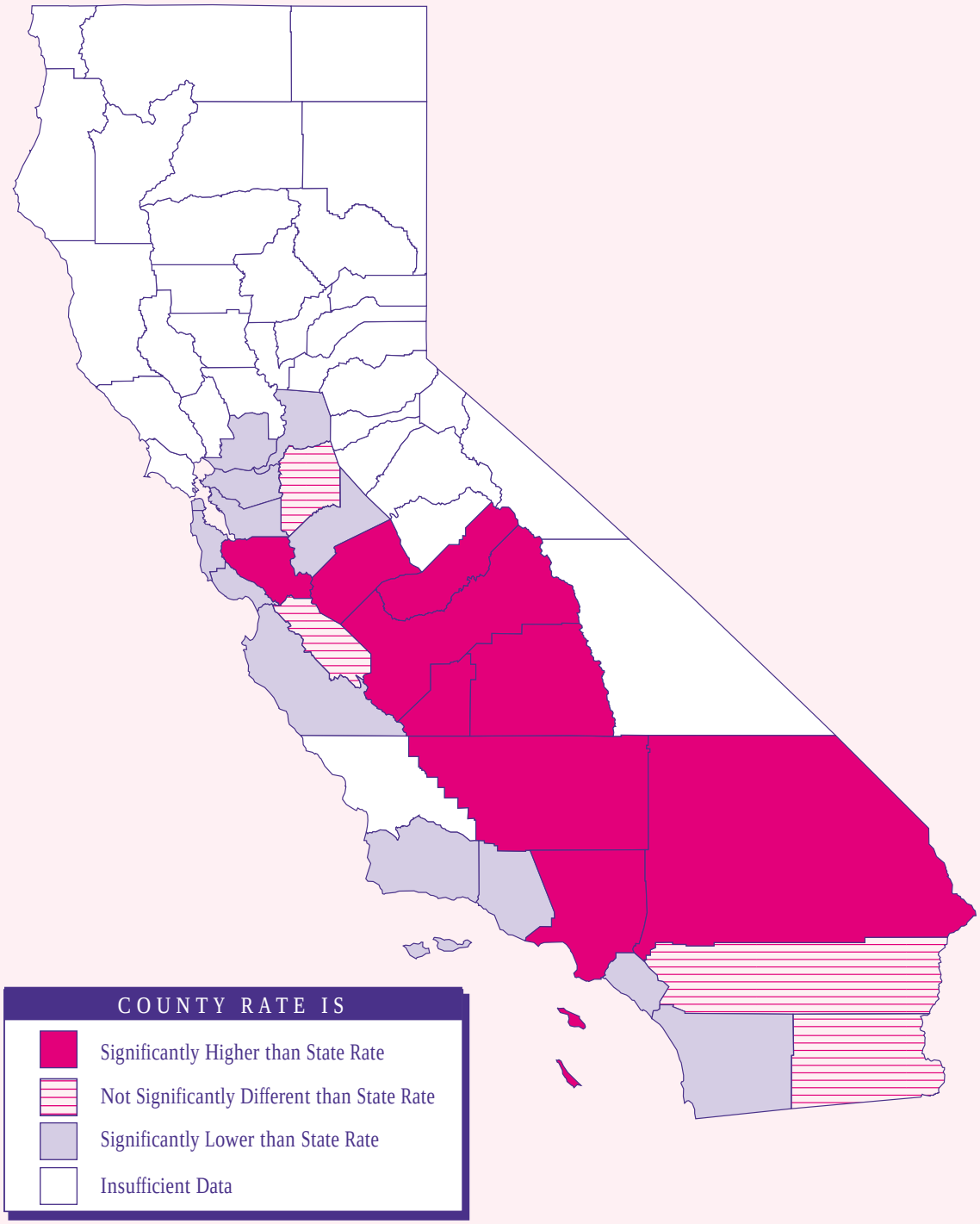


TABLE 6. IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR HISPANIC CALIFORNIANS, BY GENDER, 1989-1991.

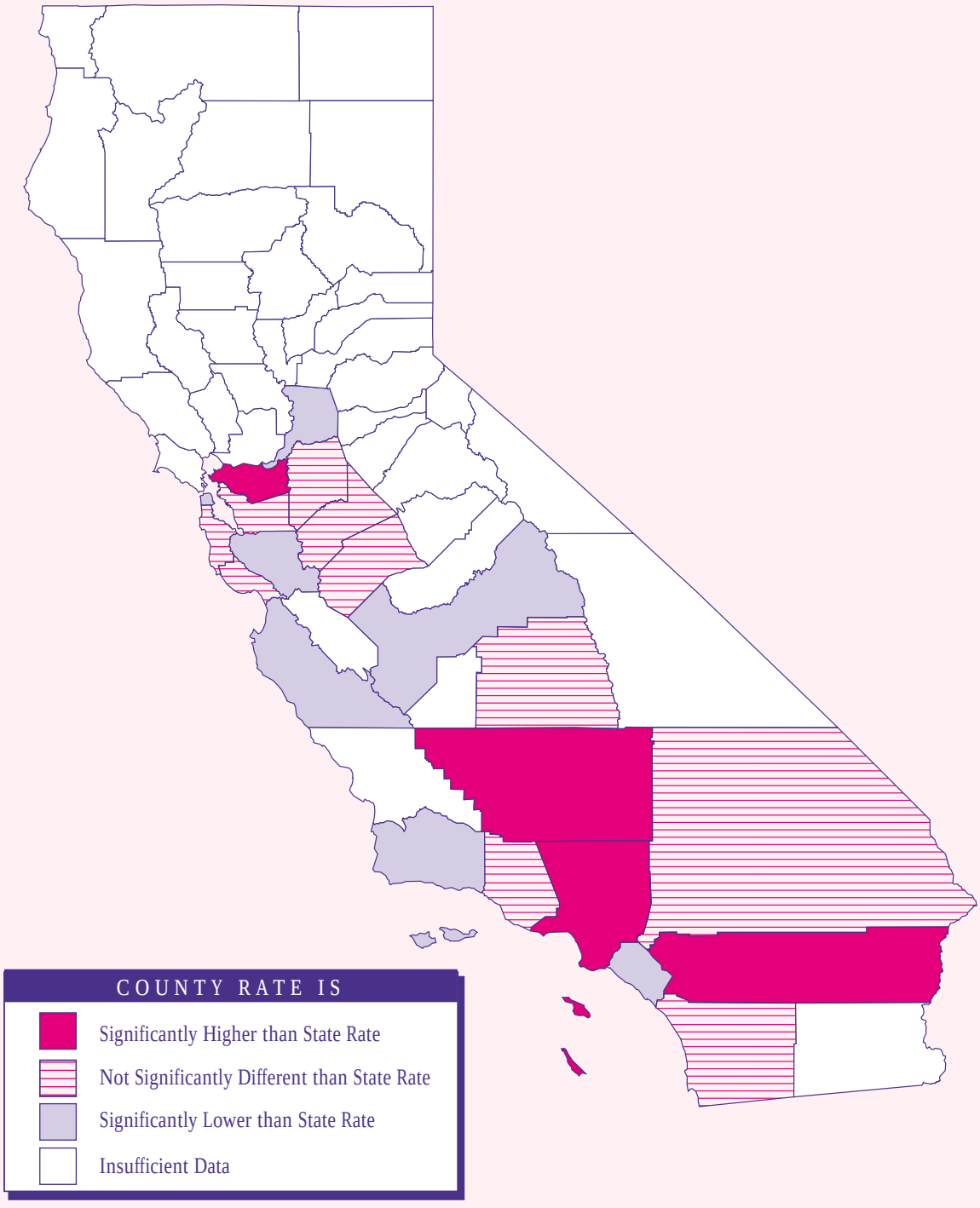
MALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
San Bernardino	212.56	1.11**
Kern	281.73	1.48**
Merced	279.75	1.47**
Tulare	263.00	1.38**
Madera	245.42	1.29**
Imperial	218.28	1.14**
Alameda	216.75	1.14**
Kings	214.11	1.12
Santa Clara	212.17	1.11**
San Francisco	202.26	1.06
Los Angeles	199.74	1.05**
Santa Cruz	194.71	1.02
Sacramento	194.00	1.02
Riverside	192.09	1.01
California	**190.89**	**1.00**
Stanislaus	183.31	0.96
San Joaquin	181.47	0.95
San Benito	176.50	0.92
Fresno	176.00	0.92*
Contra Costa	162.92	0.85*
Ventura	161.80	0.85*
Solano	156.65	0.82
San Diego	153.74	0.81*
Orange	152.10	0.80*
Monterey	148.15	0.78*
San Mateo	148.14	0.78*
Santa Barbara	144.22	0.76*
Yolo	125.88	0.66*
San Luis Obispo	122.82	0.64*
Sonoma	84.20	0.44*

FEMALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Kern	333.61	1.81**
Tulare	311.25	1.69**
Merced	306.45	1.66**
Madera	296.20	1.61**
Kings	247.49	1.34**
San Benito	219.84	1.19
Santa Clara	212.41	1.15**
San Bernardino	208.94	1.13**
Los Angeles	206.64	1.12**
Fresno	198.91	1.08**
San Joaquin	192.44	1.04
California	**184.19**	**1.00**
Imperial	180.51	0.98
Riverside	178.97	0.97
Ventura	153.05	0.83*
Santa Barbara	148.96	0.81*
Santa Cruz	148.00	0.80*
Stanislaus	147.22	0.80*
Alameda	142.91	0.78*
Orange	140.50	0.76*
San Diego	139.50	0.76*
Monterey	136.30	0.74*
San Francisco	124.77	0.68*
Solano	117.53	0.64*
Sacramento	115.25	0.63*
Contra Costa	112.57	0.61*
San Mateo	95.05	0.52*

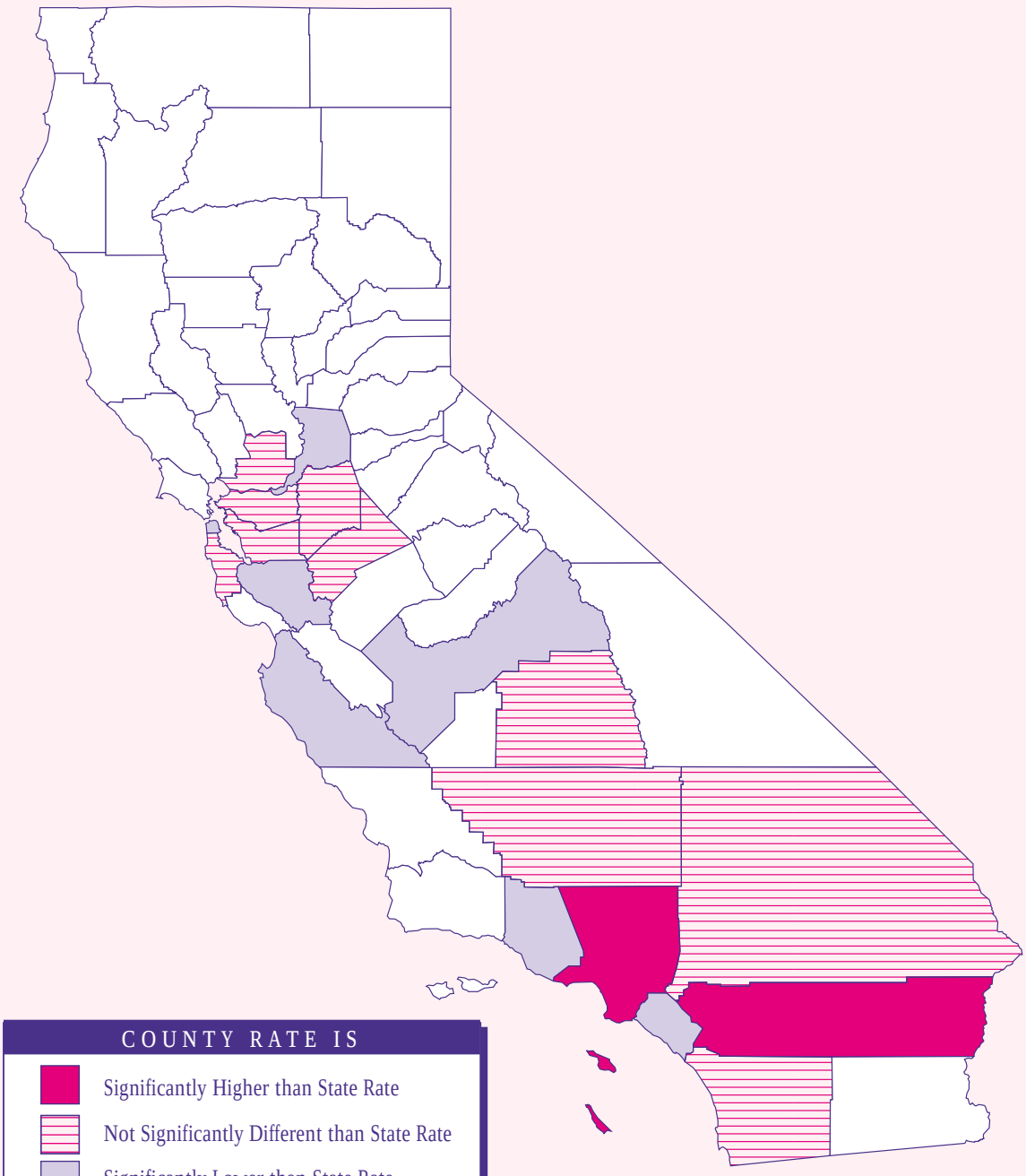
Note: Rates are per 10,000 Population and adjusted to 1990 California Population.
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.
California Department of Health Services, and University of California at San Francisco.

MAP 7. COUNTIES WITH IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR OTHER MALES IN CALIFORNIA, 1989-1991.



MAP 8. COUNTIES WITH IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR OTHER FEMALES IN CALIFORNIA, 1989-1991.



Ischemic Heart Disease Data

TABLE 7. IHD AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR OTHER CALIFORNIANS, BY GENDER, 1989-1991.

MALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Riverside	304.00	1.60**
Kern	275.42	1.45**
Contra Costa	223.18	1.17**
San Joaquin	211.85	1.11
Los Angeles	209.97	1.10**
San Bernardino	206.72	1.08
Santa Cruz	205.65	1.08
San Mateo	204.51	1.07
Tulare	201.92	1.06
Alameda	196.70	1.03
San Diego	193.72	1.02
California	**190.56**	**1.00**
Stanislaus	188.86	0.99
Santa Clara	170.69	0.90*
Ventura	170.62	0.90
Orange	161.56	0.85*
Sacramento	159.68	0.84*
San Francisco	155.60	0.82*
Monterey	148.25	0.78*
Merced	148.24	0.78
Santa Barbara	142.87	0.75*
Fresno	119.08	0.62*

FEMALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Riverside	307.93	2.24**
Stanislaus	172.45	1.25
Los Angeles	169.65	1.23**
San Joaquin	156.30	1.14
Kern	155.89	1.13
San Bernardino	151.15	1.10
Tulare	146.85	1.07
Contra Costa	140.59	1.02
California	**137.54**	**1.00**
San Mateo	132.23	0.96
Solano	131.65	0.96
Alameda	130.88	0.95
San Diego	130.85	0.95
Santa Clara	111.56	0.81*
Orange	109.97	0.80*
San Francisco	107.76	0.78*
Ventura	107.01	0.78*
Sacramento	93.91	0.68*
Fresno	90.00	0.65*
Monterey	68.48	0.50*

Note: Rates are per 10,000 population and adjusted to 1990 California Population.
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.
California Department of Health Services, and University of California at San Francisco.

STROKE HOSPITAL DISCHARGE RATES

Table 8 provides a summary of the counties with significantly high or low stroke age-adjusted hospital discharge rates, compared to the California state rate, by gender and race. For white males, 14 counties have significantly high stroke hospital discharge rates, while three counties have high rates for black males, five counties for Hispanic males, and one county for other males. For white females, ten counties have significantly high hospital discharge rates, while two counties have high rates for black females, four counties for Hispanic females, and two counties for other females.

Tables 9 and 10 show the number of hospital discharges by county and race for males and females, respectively. Considering the entire State, stroke accounts for 7.6 percent of all hospital discharges for white males and 7.9 percent for white females; 8 percent and 9.5 percent for black males and females; 6.7 percent and 6.5 percent for Hispanic males and females; and, 9.7 percent and 8.8 percent for other males and females, respectively.

Whites

Table 11 shows the hospital discharge rates, by county, for white males and females. There are substantial variations among the different counties in hospital discharge rates for white males and females. For males, there is close to a five-fold difference between the county with the highest discharge rate (Napa, 139.43) compared to the county with the lowest rate (Del Norte, 30.34) and for females a four-fold difference (Glenn, 141.76 vs. Inyo, 34.91).

Maps 9 and 10 show a broader view of the geographical variation in stroke hospital discharge rates by county for white males and females, respectively. For males, there is a cluster of eight high-rate counties located in the northern part of the State. These counties are: Lake, Colusa, Sutter, Yuba, Yolo, Napa, Sacramento, and Amador. For white females, a cluster of four neighboring counties - Tulare, Kern, Los Angeles, and San Bernardino - have significantly high hospital discharge rates for stroke.

Blacks

The geographic pattern of counties with significantly high or low hospital discharge rates for stroke is not impressive for either black males or females (Maps 11 and 12). For males, the county with the significantly highest rate (San Francisco, 196.57) is 1.8 times that of the county with the lowest rate (Solano, 108.09). For females, there is close to a two-fold difference between the county with highest discharge rate (San Francisco, 218.0) compared to the county with the lowest rate (San Mateo, 144.09) (Table 12).

Hispanics

There are substantial variations among the different counties in hospital discharge rates for stroke for Hispanic males and females. For males, there is over a three-fold difference between the county with the highest discharge rate (Imperial, 176.13) compared to the county with the lowest rate (San Mateo, 53.4). For females, there is close to a three-fold difference in rates (Butte, 142.09 vs. Contra Costa, 51.46) (Table 13).

Map 14 provides a broader view of the geographic variation of counties with high and low hospital discharge rates for females. A cluster of high-rate counties (Tulare, Kern, Los Angeles,

There are substantial variations among the different counties in hospital discharge rates for both race and gender.

San Bernardino) is located in Southern California and a cluster of low-rate counties (San Mateo, Alameda, Contra Costa, Sacramento, San Joaquin and Stanislaus) is located in Northern California.

Others

Maps 15 and 16 and Table 14 show the data, by county, for other males and females. For males, there is close to a two-fold difference between the county with the highest hospital discharge rate (Los Angeles, 105.09) compared to the county with the lowest (Fresno, 62.4). For females, there is over a two-fold difference between the county with the highest rate (Riverside, 137.85) compared to the county with the significantly lowest rate (Fresno, 65.44).

TABLE 8. COUNTIES WITH SIGNIFICANTLY HIGH OR LOW STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES BY GENDER AND RACE, CALIFORNIA, 1989-1991.

	MALE				FEMALE			
COUNTY	WHITE	BLACK	HISPANIC	OTHER	WHITE	BLACK	HISPANIC	OTHER
Alameda	H	H			Tuolumne		L	
Amador	H				Ventura		L	
Contra Costa	L				Yuba		H	
Calaveras	L							
Colusa	H							
Del Norte	L							
El Dorado	L							
Fresno	L	L		L				
Glenn								
Imperial	H		H					
Inyo	L							
Kern	H		H					
Lake	H							
Lassen	H							
Los Angeles	L	H	H	H				
Madera	L							
Marin	L							
Mariposa	L							
Merced	H							
Modoc								
Monterey	L							
Napa	H							
Nevada	L							
Orange	L		L					
Placer								
Plumas	L							
Riverside		L						
Sacramento	H							
Santa Barbara	L							
Santa Clara	L	L		L				
Santa Cruz								
San Benito	L							
San Bernardino	H							
San Diego	L		L					
San Francisco	H	H	H					
San Joaquin			L					
San Luis Obispo	L							
San Mateo		L	L					
Shasta	L							
Siskiyou	L							
Solano	L	L						
Sonoma	L							
Stanislaus	H		L					
Sutter	H							
Tehama								
Trinity	L							
Tulare	H		H					

Note: Rates are age-adjusted to 1990 Califonia population by gender.

H/L : Rate is significantly higher or lower than the state rate at 0.10 significance level.

Source: Cardiovascular Disease Outreach, Resources & Epidemiology Program. California Department of Health Services and University of California, San Francisco.

TABLE 9. STOKE DISCHARGES FOR MALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

COUNTY	WHITE NUMBER	WHITE PERCENT OF ALL DISCHARGES	BLACK NUMBER	BLACK PERCENT OF ALL DISCHARGES	HISPANIC NUMBER	HISPANIC PERCENT OF ALL DISCHARGES	OTHER NUMBER	OTHER PERCENT OF ALL DISCHARGES
California	**138,802**	**7.6**	**15,556**	**8.0**	**17,862**	**6.7**	**12,790**	**9.7**
Alameda	6,049	8.3	2,022	8.6	559	8.0	879	10.3
Alpine	0	.	0	.	0	.	0	.
Amador	353	9.7	1	4.2	1	2.2	1	5.0
Butte	1,726	9.0	10	5.3	46	7.7	10	4.9
Calaveras	247	6.4	7	23.3	2	2.7	0	.
Colusa	144	9.8	0	.	10	6.4	4	8.0
Contra Costa	3,878	7.1	579	8.1	209	7.1	265	7.9
Del Norte	176	10.0	0	.	0	.	3	6.1
El Dorado	684	6.6	1	1.8	7	6.4	5	6.6
Fresno	2,313	7.2	174	6.5	616	6.5	162	7.8
Glenn	190	8.5	1	12.5	1	0.8	1	2.8
Humboldt	817	7.4	4	5.5	12	10.6	34	9.3
Imperial	463	9.6	33	10.1	493	11.9	21	10.2
Inyo	110	6.8	1	20.0	3	6.0	7	7.4
Kern	2,840	7.9	227	8.8	475	8.0	145	11.8
Kings	341	6.9	27	6.8	85	5.5	15	11.7
Lake	666	9.3	16	8.4	7	6.4	8	7.3
Lassen	108	7.7	0	.	0	.	0	.
Los Angeles	35,716	7.5	8,148	8.3	7,879	6.5	4,939	10.1
Madera	361	6.4	14	4.7	64	5.6	10	8.0
Marin	1,310	7.3	33	6.0	14	4.6	12	3.3
Mariposa	123	7.2	0	.	0	.	1	7.7
Mendocino	614	7.4	1	3.1	8	4.2	20.	9.2
Merced	874	8.2	48	8.2	129	6.1	37	9.0
Modoc	47	6.3	0	.	1	10.0	1	4.2
Mono	11	2.9	0	.	0	.	2	15.4
Monterey	1,181	6.6	64	7.6	227	6.5	151	11.7
Napa	1,389	9.4	37	15.9	31	7.0	22	10.6

Continued

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

TABLE 9. (CONTINUED) STOKE DISCHARGES FOR MALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

	WHITE		BLACK		HISPANIC		OTHER	
COUNTY	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES
California	**138,802**	**7.6**	**15,556**	**8.0**	**17,862**	**6.7**	**12,790**	**9.7**
Nevada	650	8.0	1	7.7	2	5.1	0	.
Orange	10,516	7.3	118	5.9	761	5.7	711	8.7
Placer	1,203	7.6	6	7.7	18	4.0	15	8.9
Plumas	114	5.7	1	10.0	0	.	7	20.0
Riverside	7,486	8.2	327	7.6	664	7.0	179	7.2
Sacramento	5,344	7.4	500	7.1	347	7.4	451	10.4
San Benito	179	9.4	0	.	67	9.6	8	12.5
San Bernardino	6,222	7.7	474	7.4	797	6.4	177	8.0
San Diego	11,013	7.4	612	7.5	1,043	7.2	653	8.6
San Francisco	3,835	6.8	1,033	7.3	479	6.8	1,565	10.9
San Joaquin	2,284	7.5	196	8.1	253	5.7	315	10.0
San Luis Obispo	1,285	7.6	7	3.2	32	5.2	24	13.5
San Mateo	3,792	8.5	215	7.6	188	6.2	475	10.6
Santa Barbara	1,828	8.2	35	5.9	202	7.7	57	9.7
Santa Clara	5,030	7.0	175	5.8	845	7.4	802	9.1
Santa Cruz	1,229	8.1	11	6.4	108	7.1	61	11.4
Shasta	1,013	6.4	5	4.9	7	5.5	7	5.4
Sierra	13	4.8	0	.	0	.	0	.
Siskiyou	253	6.2	10	12.5	6	12.0	1	4.0
Solano	1,112	6.4	166	6.3	72	6.0	167	9.3
Sonoma	2,402	7.0	25	6.2	44	4.5	33	6.6
Stanislaus	2,118	7.4	39	6.9	155	5.9	45	5.9
Sutter	478	7.7	1	1.4	34	7.6	38	9.0
Tehama	434	8.6	3	20.0	18	19.8	0	.
Trinity	97	5.7	0	.	0	.	1	11.1
Tulare	1,769	9.0	33	7.6	357	7.4	70	8.5
Tuolumne	387	7.2	0	.	2	1.8	0	.
Ventura	2,826	7.3	78	8.9	408	7.2	121	8.8
Yolo	718	7.6	16	6.8	64	6.6	3	8.8
Yuba	421	7.1	21	13.1	10	3.7	20	11.6

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.
California Department of Health Services and University of California, San Francisco.

TABLE 10. STROKE DISCHARGES FOR FEMALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

COUNTY	WHITE NUMBER	WHITE PERCENT OF ALL DISCHARGES	BLACK NUMBER	BLACK PERCENT OF ALL DISCHARGES	HISPANIC NUMBER	HISPANIC PERCENT OF ALL DISCHARGES	OTHER NUMBER	OTHER PERCENT OF ALL DISCHARGES
California	**166,256**	**7.9**	**21,665**	**9.5**	**18,895**	**6.5**	**11,671**	**8.8**
Alameda	7,428	8.5	2,779	10.2	507	7.9	789	9.6
Alpine	0	.	0	.	0	.	0	.
Amador	341	9.5	0	.	2	8.0	2	11.8
Butte	1,729	8.5	10	5.3	51	9.2	11	6.6
Calaveras	242	6.8	0	.	1	2.5	2	7.1
Colusa	148	8.6	0	.	11	6.5	2	4.1
Contra Costa	4,700	7.4	797	9.2	163	5.8	243	7.2
Del Norte	135	6.9	0	.	0	.	4	4.2
El Dorado	645	6.3	2	7.4	8	5.0	0	.
Fresno	2,681	7.0	326	9.4	617	6.1	155	7.4
Glenn	230	8.7	4	33.3	7	8.9	5	13.9
Humboldt	915	7.6	6	13.6	6	6.7	32	7.9
Imperial	386	9.1	22	7.8	369	8.6	6	4.4
Inyo	162	8.7	1	11.1	4	8.7	6	5.9
Kern	3,218	7.9	265	10.4	408	6.6	75	8.8
Kings	440	7.9	24	5.8	83	5.4	15	10.4
Lake	647	9.2	30	19.1	4	5.5	6	6.6
Lassen	151	8.4	4	44.4	1	10.0	2	6.5
Los Angeles	46,697	8.3	11,828	9.8	9,012	6.3	4,700	9.3
Madera	442	7.2	42	11.5	85	6.7	12	15.0
Marin	1,432	7.2	26	6.4	15	5.5	155	8.5
Mariposa	155	8.5	0	.	1	6.7	1	8.3
Mendocino	622	6.8	3	6.0	7	5.4	16	6.1
Merced	906	7.9	55	7.7	121	5.7	27	7.0
Modoc	45	6.0	0	.	1	10.0	1	5.9
Mono	10	3.0	0	.	3	60.0	0	.
Monterey	1,621	7.7	50	6.4	217	6.0	89	7.6
Napa	1,059	8.1	3	6.4	21	5.1	8	6.2
Nevada	713	8.2	1	12.5	2	5.0	1	6.7
Orange	13,727	7.6	141	6.5	892	6.1	574	6.6
Placer	1,371	7.9	3	4.7	35	9.7	26	13.4
Plumas	182	7.8	0	.	2	9.1	1	3.2

Continued

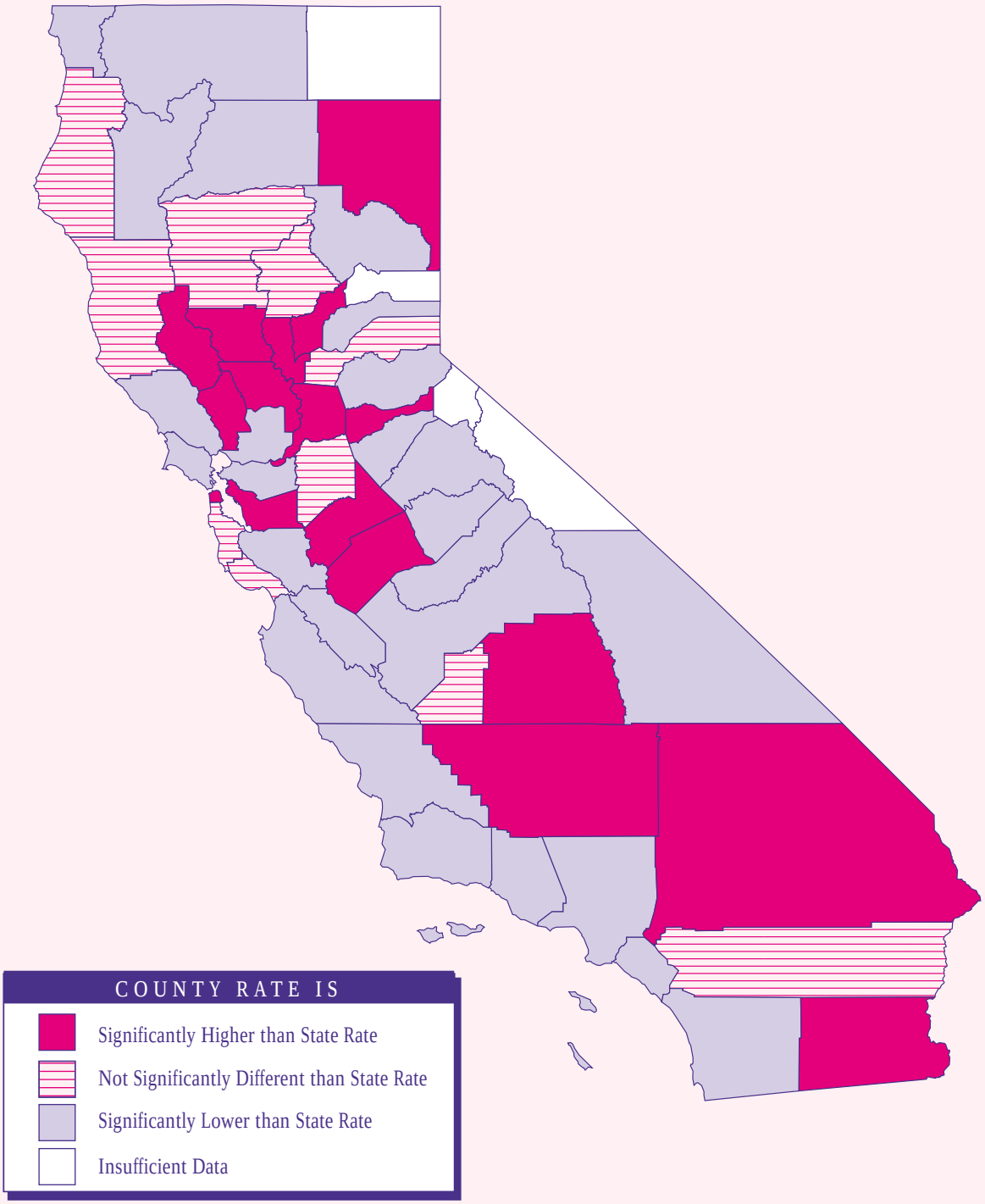
Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

TABLE 10. (CONTINUED) STROKE DISCHARGES FOR FEMALES BY RACE AND COUNTY IN CALIFORNIA, 1989-1991.

	WHITE		BLACK		HISPANIC		OTHER	
COUNTY	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES	NUMBER	PERCENT OF ALL DISCHARGES
California	**166,256**	**7.9**	**21,665**	**9.5**	**18,895**	**6.5**	**11,671**	**8.8**
Riverside	7,843	8.0	398	8.2	620	6.5	208	7.6
Sacramento	6,218	7.6	708	9.2	271	6.7	380	9.4
San Benito	153	8.0	2	16.7	64	8.1	8	19.5
San Bernardino	7,278	7.6	675	8.4	901	6.7	179	7.0
San Diego	12,940	7.6	829	8.6	1,106	7.1	650	7.9
San Francisco	4,719	8.9	1,330	10.1	547	7.9	1,568	11.4
San Joaquin	2,589	7.5	208	8.7	227	5.6	191	8.9
San Luis Obispo	1,416	7.5	9	5.8	25	4.4	17	10.9
San Mateo	4,480	8.7	253	8.1	194	5.4	434	9.4
Santa Barbara	1,975	7.5	45	7.0	204	7.3	56	10.7
Santa Clara	5,744	7.0	264	7.7	866	6.8	662	7.8
Santa Cruz	1,249	7.0	12	10.7	86	6.1	36	9.9
Shasta	1,025	6.1	1	1.2	5	5.2	8	5.2
Sierra	31	10.2	0	.	0	.	0	.
Siskiyou	302	6.9	3	5.3	1	1.9	2	11.8
Solano	1,237	6.5	246	7.3	63	6.0	144	7.6
Sonoma	2,830	7.0	34	9.5	45	5.5	41	6.8
Stanislaus	2,631	7.8	31	7.5	122	5.6	52	7.4
Sutter	496	7.4	3	2.4	28	7.6	21	7.4
Tehama	417	8.2	1	5.3	4	5.5	0	.
Trinity	131	6.8	0	.	0	.	0	.
Tulare	2,176	9.3	54	12.3	400	7.5	57	9.1
Tuolumne	420	7.4	0	.	1	1.4	1	2.7
Ventura	3,625	7.6	107	10.8	398	6.8	81	5.4
Yolo	747	7..5	25	10.9	55	7.1	6	11.0
Yuba	404	7.1	5	4.0	6	3.7	6	5.0

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

MAP 9. COUNTIES WITH STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR WHITE MALES IN CALIFORNIA, 1989-1991.



Map 10. Counties with Stroke Age-Adjusted Hospital Discharge Rates Significantly Different from the State Rate for White Females in California, 1989-1991.

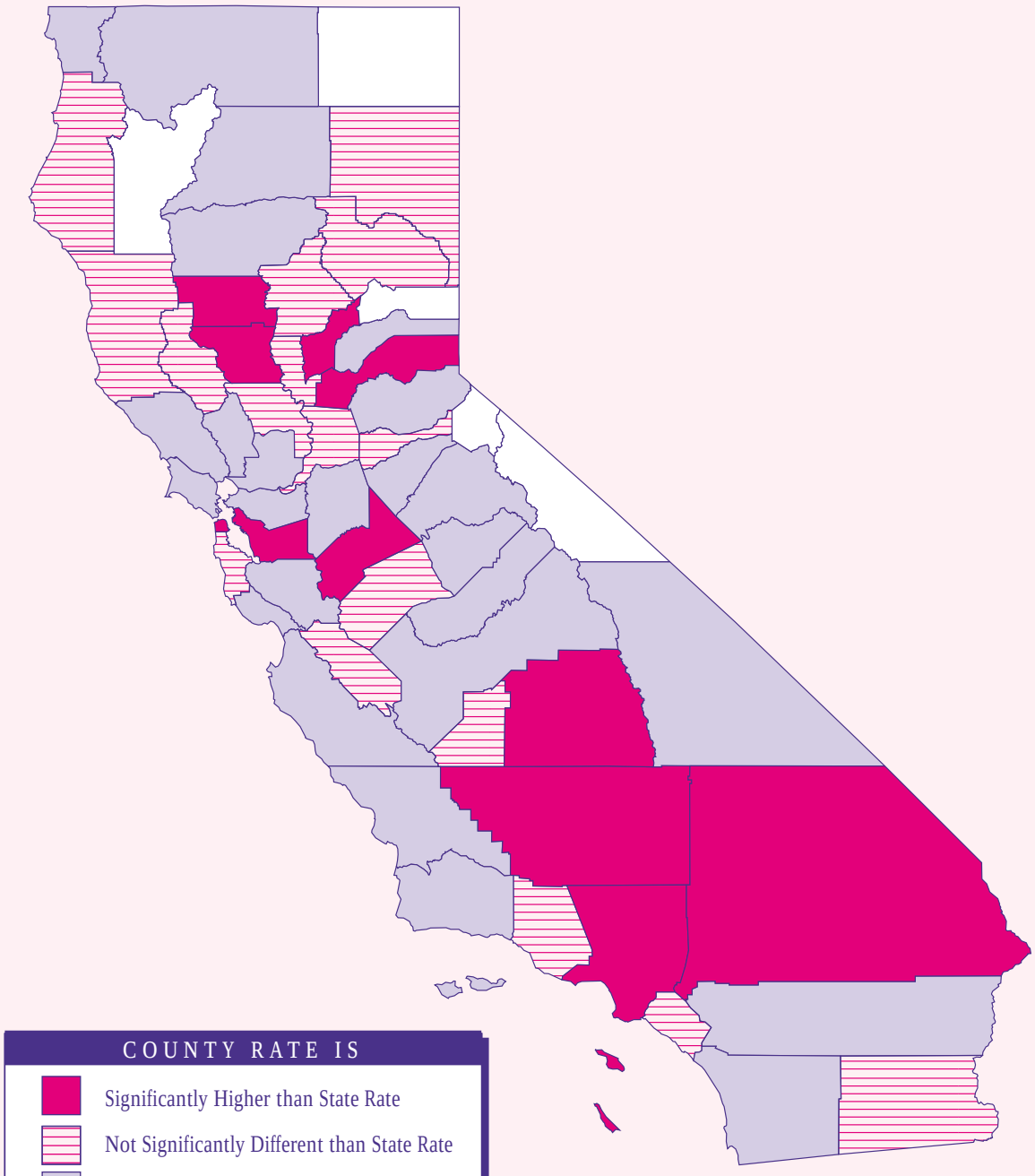


TABLE 11. STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR WHITE CALIFORNIANS, BY GENDER, 1989-1991.

MALE

QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO
Highest			
	Napa	139.43	1.41**
	Colusa	132.84	1.34**
	Yuba	127.11	1.28**
	Sutter	122.39	1.23**
	Imperial	121.77	1.23**
	Merced	120.28	1.21**
	Alameda	119.41	1.20**
	Amador	116.43	1.17**
	San Francisco	116.03	1.17**
	Tulare	114.10	1.15**
	Kern	113.18	1.14**
	Lassen	110.73	1.12**
	Lake	108.36	1.09**
	Yolo	107.19	1.08**
Third			
	Stanislaus	105.66	1.07**
	San Bernardino	104.31	1.05**
	Sacramento	104.00	1.05**
	Placer	103.91	1.05
	Butte	103.10	1.04
	Glenn	102.60	1.03
	San Mateo	102.44	1.03
	Mendocino	100.41	1.01
	San Joaquin	99.32	1.00
	California	**99.18**	**1.00**
	Humboldt	98.98	1.00
	Riverside	98.26	0.99
	Kings	97.77	0.99
	Santa Cruz	95.80	0.97
Second			
	Orange	95.72	0.97*
	Contra Costa	92.29	0.93*
	Tehama	91.86	0.93

FEMALE

QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO
Highest			
	Glenn	141.76	1.35**
	Colusa	136.16	1.29**
	Yuba	125.62	1.19**
	Tulare	124.20	1.18**
	Los Angeles	122.65	1.17**
	Alameda	120.39	1.14**
	Kern	119.98	1.14**
	Imperial	118.62	1.13
	Amador	116.41	1.11
	Sutter	116.32	1.11
	Kings	115.08	1.09
	Stanislaus	114.82	1.09**
	Merced	114.52	1.09
	Placer	113.96	1.08**
Third			
	San Francisco	113.70	1.08**
	San Bernardino	111.00	1.05**
	Lake	110.25	1.05
	Plumas	107.31	1.02
	Humboldt	107.07	1.02
	San Mateo	106.29	1.01
	Sacramento	105.93	1.01
	California	**105.23**	**1.00**
	Orange	104.41	0.99
	Ventura	103.62	0.98
	Yolo	101.75	0.97
	Lassen	101.39	0.96
	Riverside	99.25	0.94*
	San Joaquin	99.04	0.94*
Second			
	Contra Costa	98.87	0.94*
	Butte	98.62	0.94
	Mendocino	97.98	0.93

Continued

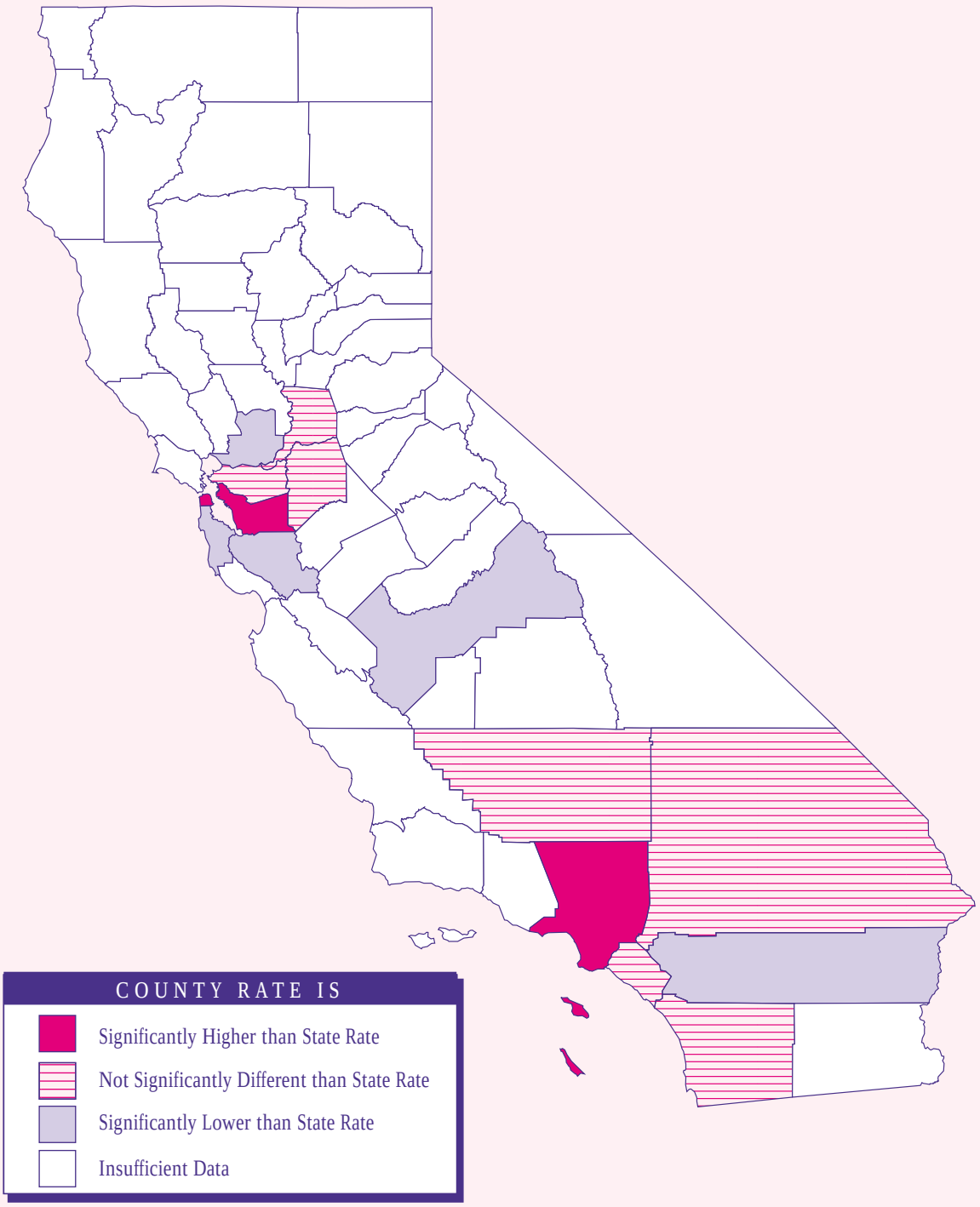
TABLE 11. (CONTINUED) STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR WHITE CALIFORNIANS, BY GENDER, 1989-1991.

MALE				FEMALE			
QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO	QUARTILE	COUNTY	DISCHARGE RATE	RELATIVE RATIO
	Ventura	89.83	0.91*		San Benito	95.45	0.91
	Solano	89.17	0.90*		Napa	95.41	0.91*
	Shasta	86.75	0.87*		Solano	94.22	0.90*
	Sonoma	86.65	0.87*		Monterey	92.19	0.88*
	Santa Clara	86.55	0.87*		Nevada	91.61	0.87*
	Marin	83.34	0.84*		San Diego	89.69	0.85*
	San Diego	83.00	0.84*		Sonoma	89.55	0.85*
	Santa Barbara	82.65	0.83*		Tehama	88.73	0.84*
	Mariposa	82.44	0.83*		Shasta	86.27	0.82*
	Nevada	81.44	0.82*		Madera	85.36	0.81*
	Fresno	81.03	0.82*		Santa Clara	84.74	0.81*
Lowest				***Lowest***			
	San Luis Obispo	79.21	0.80*		San Luis Obispo	82.62	0.79*
	Monterey	77.49	0.78*		Marin	82.30	0.78*
	El Dorado	76.41	0.77*		Calaveras	81.50	0.77*
	Calaveras	75.50	0.76*		Fresno	80.00	0.76*
	Madera	70.30	0.71*		Santa Cruz	78.93	0.75*
	Siskiyou	62.19	0.63*		El Dorado	78.22	0.74*
	Los Angeles	61.78	0.62*		Modoc	76.73	0.73*
	Plumas	57.37	0.58*		Santa Barbara	76.21	0.72*
	Tuolumne	56.60	0.57*		Siskiyou	75.88	0.72*
	Inyo	56.27	0.57*		Mariposa	72.08	0.68*
	San Benito	55.80	0.56*		Del Norte	58.91	0.56*
	Trinity	38.66	0.39*		Tuolumne	42.44	0.40*
	Del Norte	30.34	0.31*		Inyo	34.91	0.33*

Note: *Rates are per 10,000 population and adjusted to 1990 California Population.*
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.
California Department of Health Services, and University of California at San Francisco.

MAP 11. COUNTIES WITH STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR BLACK MALES IN CALIFORNIA, 1989-1991.



MAP 12. COUNTIES WITH STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR BLACK FEMALES IN CALIFORNIA, 1989-1991.

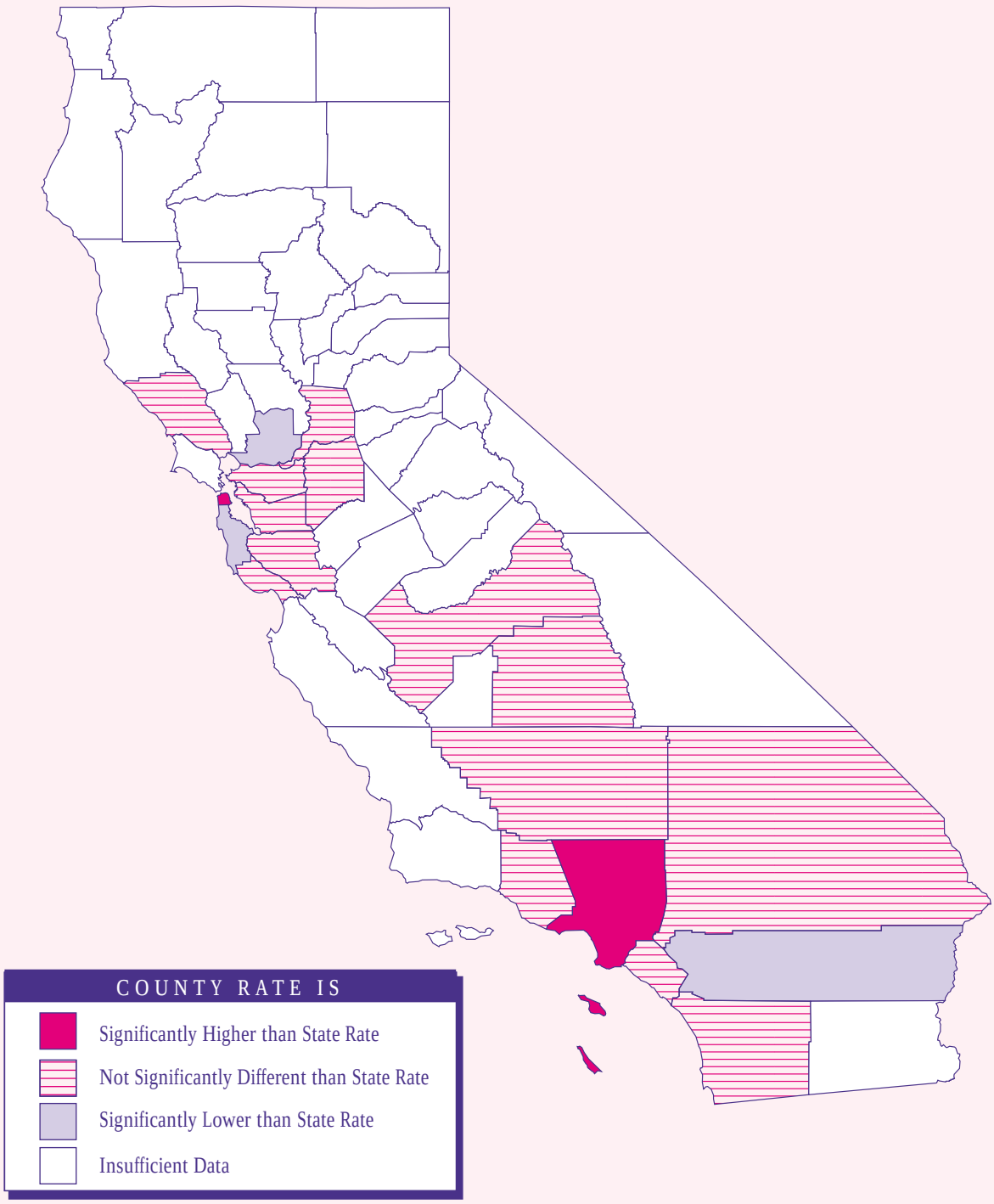


TABLE 12. STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR BLACK CALIFORNIANS, BY GENDER, 1989-1991.

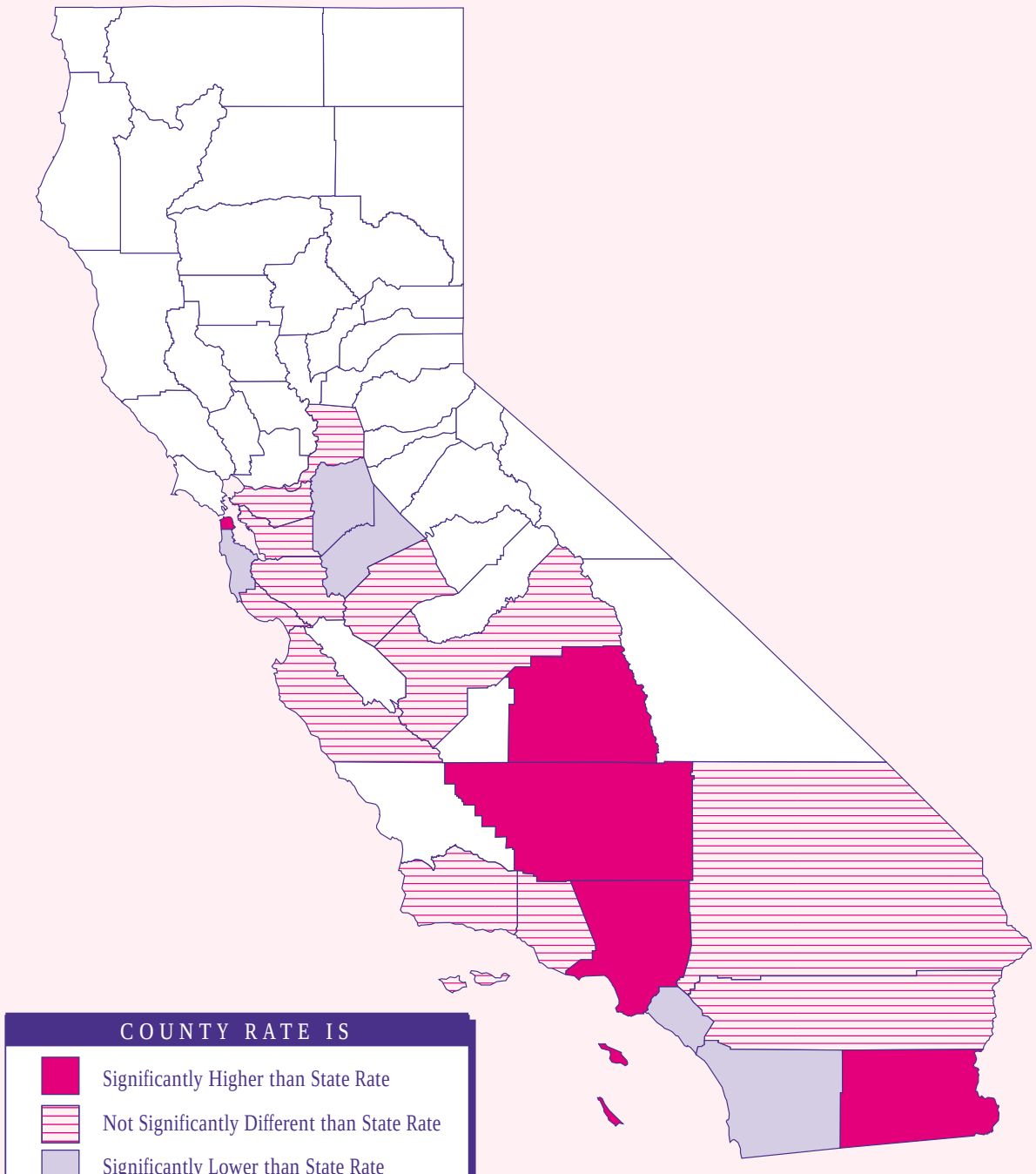
MALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Merced	386.81	1.32**
San Francisco	196.57	1.20**
Alameda	176.07	1.08**
Los Angeles	174.53	1.07**
Contra Costa	170.98	1.04
California	**163.69**	**1.00**
Kern	163.50	1.00
San Joaquin	152.72	0.93
San Bernardino	149.92	0.92
San Diego	149.58	0.91
Sacramento	146.04	0.89
Orange	129.43	0.79
Riverside	127.08	0.78*
San Mateo	125.10	0.76*
Santa Clara	122.82	0.75*
Fresno	110.41	0.67*
Solano	108.09	0.66*

FEMALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Ventura	246.40	1.23
Sonoma	220.82	1.10
San Francisco	218.00	1.09**
Contra Costa	217.42	1.08
Tulare	216.16	1.08
Los Angeles	209.68	1.05**
San Bernardino	203.79	1.02
Alameda	203.35	1.01
Santa Cruz	203.31	1.01
California	**200.52**	**1.00**
Sacramento	196.94	0.98
Santa Clara	190.31	0.95
Kern	189.86	0.95
Fresno	188.53	0.94
San Diego	181.71	0.91
Orange	173.52	0.87
San Joaquin	167.52	0.84
Solano	155.60	0.78*
Riverside	149.40	0.75*

Note: *Rates are per 10,000 population and adjusted to 1990 California Population.*
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.*
California Department of Health Services, and University of California at San Francisco.

Map 13. Counties with Stroke Age-Adjusted Hospital Discharge Rates Significantly Different from the State Rate for Hispanic Males in California, 1989-1991.



MAP 14. COUNTIES WITH STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR HISPANIC FEMALES IN CALIFORNIA, 1989-1991.

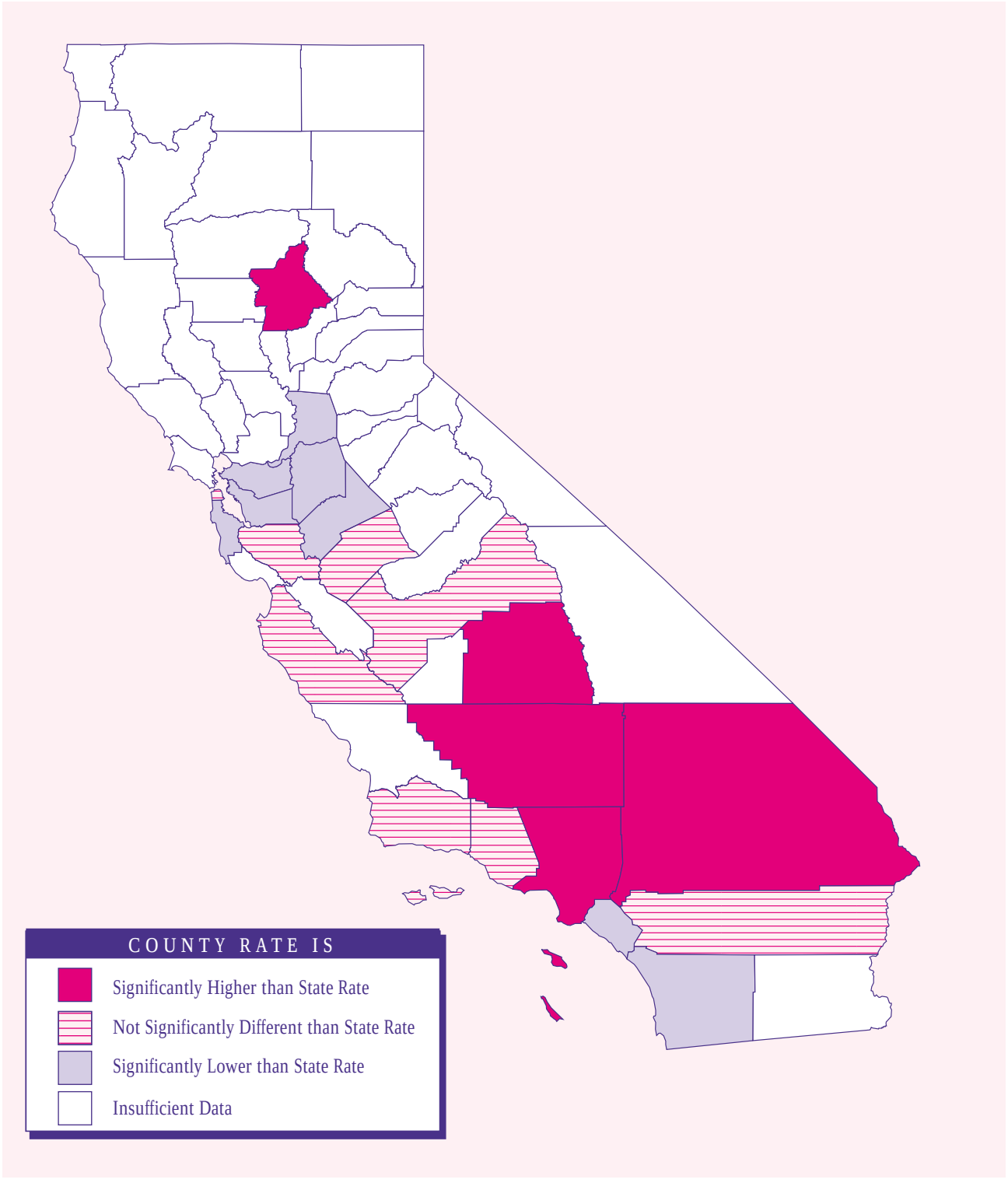


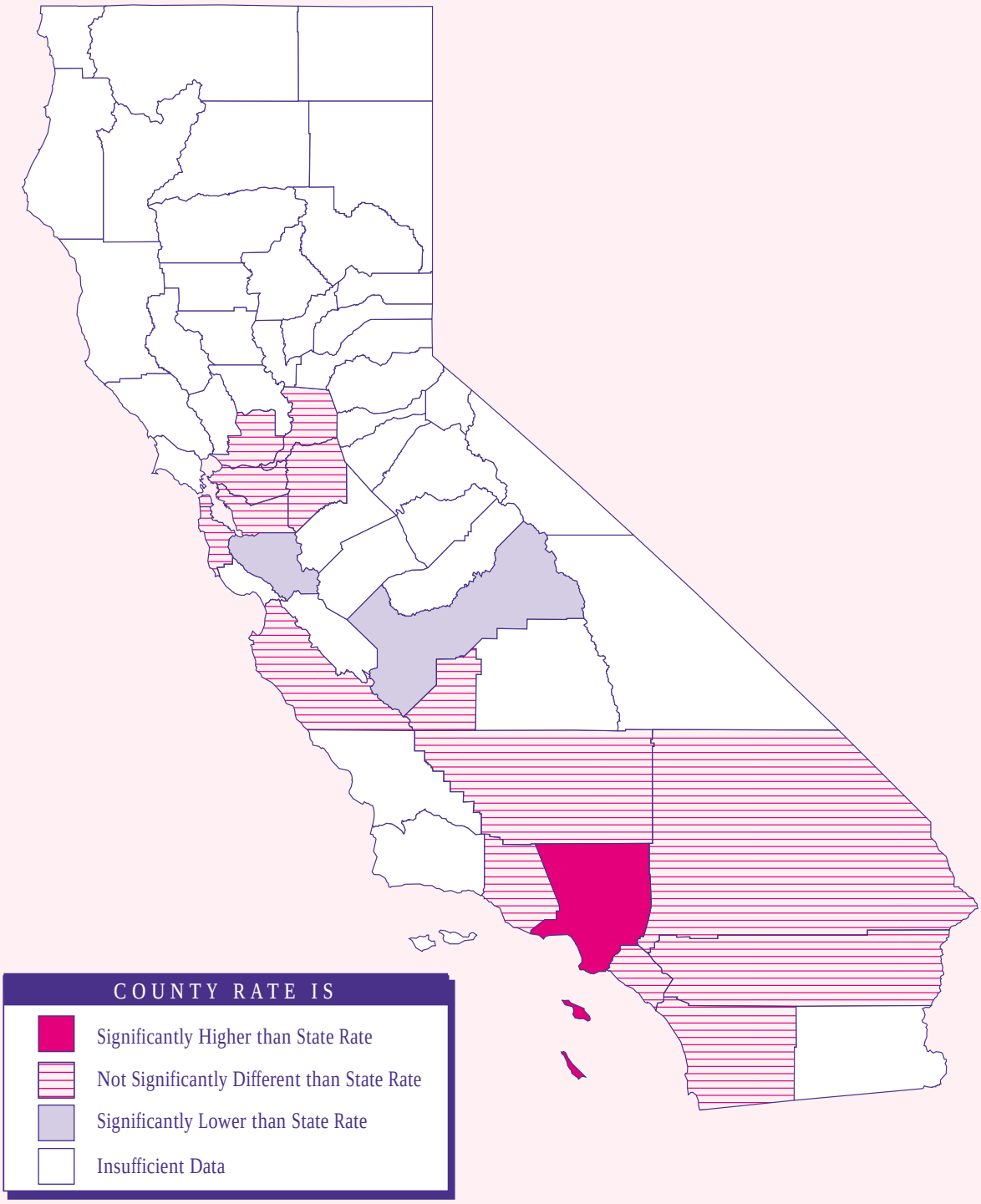
TABLE 13. STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATE AND RELATIVE RATIO FOR HISPANIC CALIFORNIANS, BY GENDER, 1989-1991.

MALE			FEMALE		
COUNTY	DISCHARGE RATE	RELATIVE RATIO	COUNTY	DISCHARGE RATE	RELATIVE RATIO
Imperial	176.13	2.12**	Butte	142.09	1.67**
Kern	110.50	1.33**	Tulare	131.45	1.54**
Tulare	100.64	1.21**	Kern	115.54	1.36**
San Francisco	97.06	1.17**	San Bernardino	96.14	1.13**
Los Angeles	89.72	1.08**	Los Angeles	93.17	1.09**
Santa Clara	87.88	1.06	Fresno	89.42	1.05
Alameda	84.25	1.01	Santa Clara	85.85	1.01
Merced	83.37	1.00			
			California	**85.22**	**1.00**
California	**83.10**	**1.00**			
			San Francisco	82.44	0.97
Sacramento	81.41	0.98	Ventura	80.19	0.94
San Bernardino	81.38	0.98	Merced	79.97	0.94
Fresno	80.88	0.97	Riverside	78.86	0.93
Ventura	78.28	0.94	Monterey	78.30	0.92
Santa Cruz	77.51	0.93	Santa Barbara	74.06	0.87
Riverside	76.87	0.93	Orange	73.76	0.87*
San Diego	73.78	0.89*	Alameda	72.84	0.85*
Monterey	72.04	0.87	San Diego	71.09	0.83*
Santa Barbara	69.35	0.83	Sacramento	68.71	0.81*
Contra Costa	68.88	0.83	Stanislaus	64.28	0.75*
Orange	68.25	0.82*	San Joaquin	63.41	0.74*
Stanislaus	62.74	0.76*	San Mateo	51.97	0.61*
San Joaquin	62.29	0.75*	Contra Costa	51.46	0.60*
San Mateo	53.40	0.64*			

Note: *Rates are per 10,000 population and adjusted to 1990 California Population.*
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services, and University of California at San Francisco.*

MAP 15. COUNTIES WITH STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR OTHER MALES IN CALIFORNIA, 1989-1991.



Map 16. Counties with Stroke Age-Adjusted Hospital Discharge Rates Significantly Different from the State Rate for Other Females in California, 1989-1991.

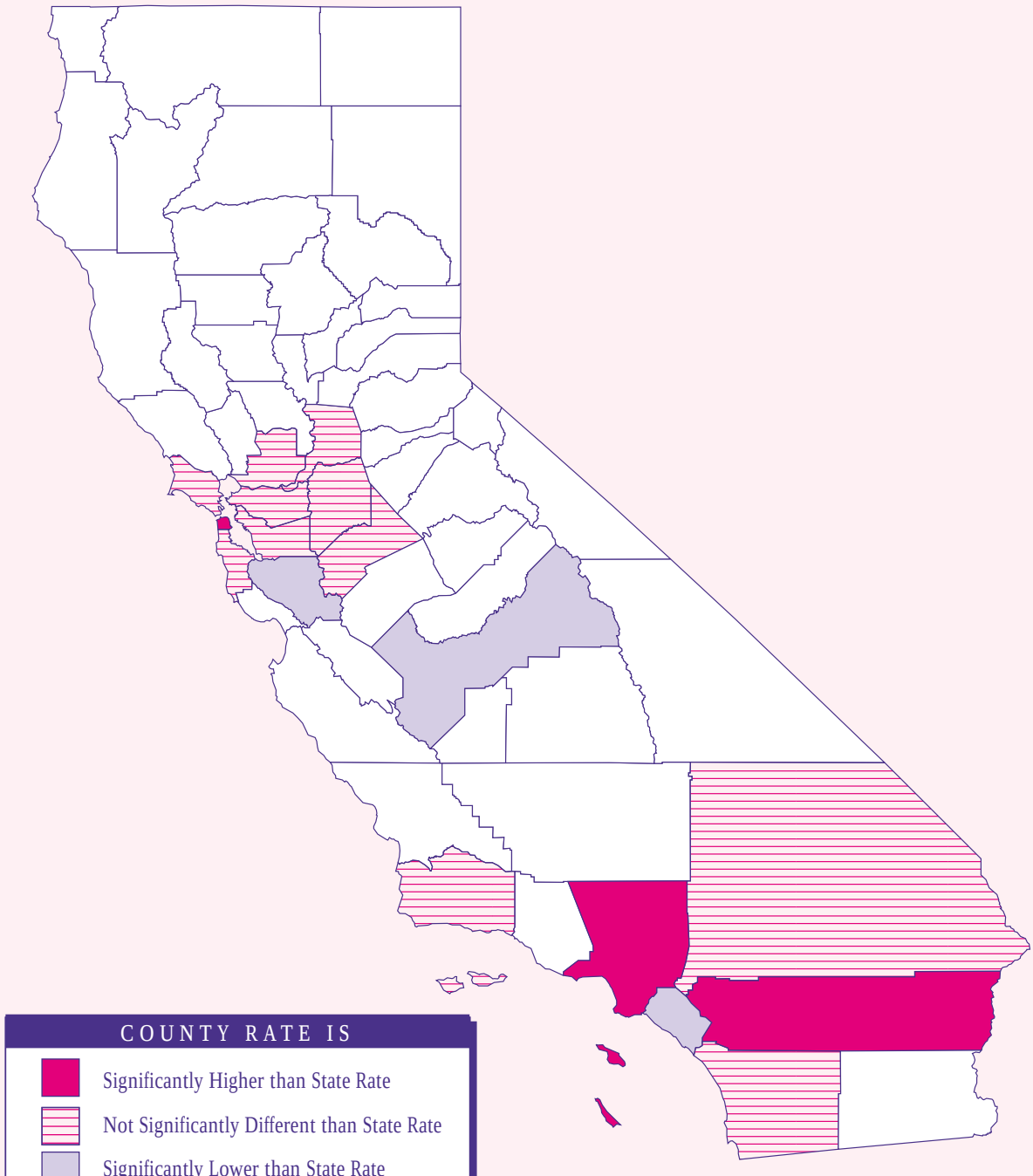


TABLE 14. STROKE AGE-ADJUSTED HOSPITAL DISCHARGE RATES AND RELATIVE RATIOS FOR OTHER CALIFORNIANS, BY GENDER, 1989-1991.

MALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Los Angeles	105.09	1.15**
Riverside	102.75	1.12
San Mateo	101.01	1.10
Kings	95.21	1.04
Kern	94.13	1.03
San Francisco	94.04	1.03
Alameda	93.12	1.02
Solano	91.82	1.00
California	**91.66**	**1.00**
Sacramento	89.50	0.98
San Diego	88.98	0.97
Orange	83.99	0.92
Contra Costa	82.92	0.90
Monterey	82.13	0.90
San Joaquin	81.74	0.89
Ventura	81.40	0.89
San Bernardino	80.49	0.88
Santa Clara	74.82	0.82*
Fresno	62.40	0.68*

FEMALE COUNTY	DISCHARGE RATE	RELATIVE RATIO
Riverside	137.85	1.52**
Los Angeles	105.61	1.17**
San Francisco	96.27	1.06**
San Mateo	95.20	1.05
California	**90.47**	**1.00**
Alameda	88.50	0.98
San Joaquin	86.59	0.96
San Diego	85.67	0.95
Sacramento	83.58	0.92
Contra Costa	75.61	0.84
San Bernardino	74.19	0.82
Orange	72.13	0.80*
Stanislaus	71.10	0.79
Santa Clara	69.79	0.77*
Solano	69.61	0.77
Santa Barbara	67.64	0.75
Fresno	65.44	0.72*
Marin	50.46	0.56

Note: *Rates are per 10,000 population and adjusted to 1990 California Population.*
Relative Ratio is ratio of county to statewide rate.
** County has significantly lower rate than state rate with an overall significance level of 0.10.*
*** County has significantly higher rate than state rate with an overall significance level of 0.10.*
Non-listed counties have insufficient data, therefore unreliable rates.

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program.*
California Department of Health Services, and University of California at San Francisco.

All too often the disability associated with CVD is not addressed because it is difficult to assess. Most people tend to think of CVD as resulting in sudden death. However, only one in five people, without previous clinical symptoms of CVD, dies suddenly from an arrhythmia or heart attack. The majority of people go on to live lives affected by conditions, such as shortness of breath, difficulty walking short distances, or simple activities of daily living (i.e., preparing a meal). In this report the magnitude of disability from heart disease and stroke can be seen where it has great impact - at the county level.

In general, the counties with significantly higher IHD hospital discharge rates compared to the California State rate are located throughout the Central Valley and into Southern California. For stroke, the majority of high-rate counties are located in Southern California. Whites have by far the greatest frequency of hospitalizations for IHD and stroke. However, white men (322.6) have the highest discharge rates for IHD and black women (200.5) for stroke (Figures 1 and 2).

The statewide estimates for IHD and stroke compare favorably in our report to that published in 1987, *Ischemic Heart Disease, Hypertension and Cerebrovascular Disease: Deaths and Hospitalizations California, 1983-1987*. In the former report, white men and black women had the highest rates for IHD and stroke discharges, respectively. Similarly to the previous report, we see many of the same Southern California counties having significantly high hospital discharge rates for IHD and stroke.

Some caution is necessary when interpreting the discharge rates in this report. The absence of a unique identifier on the hospital discharge record means that a given individual could be represented more than once per year if they had been hospitalized more than once in that year. Thus, to the extent that there are multiple admissions for the same condition in the same patient during a single year, the rates reported will be overestimates of the rate of hospitalizations per population. However, when there are multiple admissions for the same condition in the same patient it underscores the significance of the problem of disabilities associated with IHD and stroke.

The findings in this report point to large variations between California counties for IHD and stroke hospital discharge rates. Unfortunately, the data in this report do not provide information on why some counties have significantly high IHD and stroke hospital discharge rates compared to the statewide rate. However, we do know that a certain degree of the variation in rates may be explained by differences in: access to preventive medical care, screening and treatment; patterns of survival; and, exposure to risk factors. Further investigation, at the county level, and even smaller units, i.e., city and census tract, will be required to identify the causes for such wide variations in rates.

In the interim, there remains much that can be done for CVD prevention. The benefits of controlling high blood pressure and elevated blood cholesterol levels are well documented. The cessation of tobacco use is known to reduce the risk of heart disease, while

Discussion

New policies implemented at the local and state levels could promote improvements to cardiovascular health for all Californians.

weight control, a low-fat diet, and regular physical activity promote cardiovascular health. In addition, recent attention to disparities in CVD status, by ethnicity and socioeconomic status, may lead to new strategies for reducing the gap.

We also have the tools to prevent CVD and its complications. The media can effectively increase awareness of the problem of CVD. By working together, community organizations and local government agencies can expand current programs that promote heart healthy habits. Advocacy in the health arena could promote primary prevention of CVD through periodic screening for hypertension and high blood cholesterol and by routine inquiry of behavioral risk factors such as tobacco use, dietary fat intake, and inadequate physical activity. Moreover, new policies implemented at the local and state levels could create healthier environments that promote improvements to cardiovascular health for all Californians.

Appendix A

A NOTE ON HOSPITAL DISCHARGE DATA

CONFIDENTIALITY

For protection of patient confidentiality, standard non-confidential tapes are available in two formats: Tape A and Tape B. Tape A has had the record linkage number (a unique patient identifier) since July 1, 1990, but only contains the first three digits of the patient's zip code. Tape B contains a five digit zip code, but does not contain the unique identifier nor the day of week of admission. In addition, the month of admission is converted to the quarter of admission and the patient's age is given in terms of 14 age categories.

COUNTY OF RESIDENCE OF THE PATIENT

The county code of patient residence was first made available for the entire year of data starting in 1991. OSHPD purchases tapes regularly from the U.S. Postal Service, containing the name of the geographical area served and the name of the primary county, for every current zip code. Patient five-digit zip codes have been translated into counties and the county number stored on the tape, by using the most recently received postal information tape. In this report, we requested from OSHPD the zip code list with the name of the primary county served and then assigned the county code for patients who were discharged at years of 1989 and 1990, using their five-digit zip codes of residence. Further information regarding concerns about the error involved in determining county of residence by use of the zip code can be found in 1991 Discharge Data Tape Format Documentation, Appendix F, Office of Statewide Health Planning and Development, October, 1992.

APPENDIX B

TECHNICAL NOTES

RATES

One of the most frequent interests in epidemiology is the comparison of the rates for some event or characteristic across different populations. An unadjusted rate, usually referred to as a crude rate or an overall rate, is obtained by dividing the total number of events of interest, say hospitalization due to heart disease, by the total population at risk. A crude rate is usually expressed on a convenient base, say 10,000. For example, in 1990, among the California population of 12,910,668 age 35 and older there were 337,846 non-pregnancy related IHD hospital discharges. Thus, the crude 1990 non-pregnancy related IHD discharge rate was 337,846/12,910,668 = 261.7 per 10,000 for the population of age 35 and older.

The stratum-specific rates are rates presented for individuals with certain characteristics in specific strata, such as different gender and race/ethnic subgroups, divided by the population size in the corresponding strata. For instance, in 1990, there were 60,941 non-pregnancy related IHD discharges among the California population, of 4,600,561 white females who were 75 years of age or older. Thus, the 1990 age-, gender- and race-specific discharge rate was 60,941/4,600,561 = 1,324.6 per 10,000.

If the populations being compared were similar with respect to factors associated with the event under study, factors such as age, sex, race, or some socio-economic factors, there would be no problem in comparing the crude rates as they stand. However, if the study populations are not similarly constituted, the direct comparison of the crude rates would be misleading. For example, counties with a large component of elderly may have a higher hospital discharge rate simply because the risk of being hospitalized is so strongly influenced by age. This effect of different compositions among populations can be removed by the procedure of "age-adjustment."

The direct method is used to adjust the rates in this report. It is derived by applying the stratum specific rates observed in each of the populations, say counties, to a single "standard" or "reference" population. The age-adjusted rate is obtained by multiplying the age-specific rates by the corresponding stratum-specific proportions of the standard population and then summing the apportioned specific rates. The adjusted rate is also referred to as the standardized rate.

Adjusted rates allow us to put different populations on the same footing with respect to the effect of different compositions among populations. This single summary index for a population is more easily compared with other summary indices than are long lists of stratum-specific rates. However, the adjusted rates should be used with caution, since selecting different standard populations or choosing different stratum cut-offs for constructing strata, say age-stratum, would result in different numerical values of adjusted rates. In this report, the age-adjusted discharge rates were calculated for each county in California. Male and female rates were adjusted to the California 1990 male and female population, respectively. The five age cut-offs for age-adjustment are 35-44, 45-54, 55-64, 65-74, and 75+ years.

STATISTICAL ISSUES

The relative standard error of an estimate, say age-adjusted rate, is obtained by dividing the standard error of the estimate by the estimate itself. In other words, the relative standard error measures the spread, or the reliability of the estimate relative to the estimate itself. If the relative standard error is greater than 0.30, then we say the estimate is not statistically reliable. In this report, we stated it as "insufficient data was available." Furthermore, for counties with the number of total IHD or stroke discharges less than 100, we also noted "insufficient data was available."

There are 58 counties in California. Therefore, the county:state ratio test would be performed 58 times for each sex across race/ethnic subgroup. In this case, using single step Bonferroni procedure to control the type I error rate at 0.05 significance level would be too conservative. Thus, the Holm's method, a step-down Bonferroni type of procedure based on p-values, was implemented for this large number of comparisons, at .10 significance level.

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